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MURRAY VALLEY ENCEPHALITIS: EPIDEMIOLOGICAL ASPECTS.[1]

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A PREVIOUS article reported an outbreak of Murray Valley encephalitis (MVE) which occurred during the first three months of 1951. The present series of papers will describe that outbreak in greater detail and will record the research which has been undertaken into the disease. It is hoped that this paper will serve as an introduction to the series; for this reason both detail and theoretical discussion have been avoided.

History of Investigation.

Early in February, 1951, information was received from Mildura in north-western Victoria, and from Mooroopna in north-eastern Victoria, that several patients suffering from severe encephalitis had been admitted to hospital. Such an unusual occurrence prompted investigation.

On February 8 a male patient, aged nineteen years, died at Mooroopna Hospital. His history (Case 15) is detailed in a subsequent paper by Dr. E. Graeme Robertson and Dr. H. McLorinan. Specimens of central nervous system tissue were brought to Melbourne on dry ice; from these specimens a virus was isolated by Mr. E. L. French, as he describes in a later paper of this series. It was fortunate that this virus produced a good titre of complement-fixing antigen when grown on the chorio-allantois of the chick embryo; this fact made possible an extensive serological survey of both sick and healthy human beings and animals in Victoria, and later throughout Australia.

Inquiries initiated during the second and third weeks of February brought to light a number of cases of severe encephalitis which had occurred in northern Victoria since January 5, 1951. During the last two weeks of February, and during March, further cases of similar clinical picture to Case 15 were reported from practitioners in northern Victoria. In many instances the victims were admitted to Melbourne hospitals, a procedure which facilitated detailed observation by members of the investigating team. In other cases members of the team visited patients in the country. In some instances only a history of the features of a recent attack was available to us, the patient having either recovered completely or died before our attention had been directed to him.

Definition of Cases.

Under these diverse circumstances it was particularly difficult to establish a rigid clinical criterion for the diagnosis of Murray Valley encephalitis. For the purpose of this series of papers a case is provisionally accepted as a case of Murray Valley encephalitis if the clinical picture was that of a severe encephalitis, such as is described in the clinical paper of this series, and if the patient had recently been in the Murray Valley district of Victoria or in the immediately adjacent areas in southern New South Wales.

[1] This work was aided by a grant from the National Health and Medical Research Council, Canberra.

On this basis 40 severe cases of the disease came to our notice during the first fifteen weeks of 1951. In a later paper of this series we discuss the serological evidence supporting the clinical diagnosis in these 40 cases. At this juncture it suffices to say that the clinical diagnosis was accurate in the great majority and perhaps in all of the 40 cases.

By contrast, no Murray Valley encephalitis antibody was developed during convalescence by any of four patients suffering from severe encephalitis examined during the same fifteen weeks, from regions further south than the Murray Valley.

Details of the 40 Murray Valley cases are presented in Table I.

TABLE I.

The Forty Cases of Murray Valley Encephalitis in the Victorian Outbreak, 1951.

Case Number.	Date of Onset.	Age.	Sex.	Probable Region where Infected.	Outcome.
1	5.1.51	3 months.	M.	Kyabram.	Died.
2	6.1.51	22 months.	M.	Albury, N.S.W.	Survived.
3	8.1.51	6 years.	M.	Balranald, N.S.W.	Survived.
4	13.1.51	5 months.	F.	Koondrook.	Died.
5	13.1.51	7 years.	M.	Cardross.	Died.
6	15.1.51	35 years.	M.	Kyabram.	Survived.
7	17.1.51	13 years.	M.	Beechworth.	Died.
8	20.1.51	69 years.	M.	Mildura.	Survived.
9	21.1.51	22 years.	M.	Mildura.	Died.
10	22.1.51	28 years.	M.	Mildura.	Survived.
11	23.1.51	2 years.	F.	Wentworth, N.S.W.	Survived.
12	24.1.51	63 years.	M.	Charlton.	Survived.
13	26.1.51	4 years.	M.	Stanhope.	Died.
14	1.2.51	7 years.	M.	Leitchville.	Survived.
15	2.2.51	19 years.	M.	Numurkah.	Died.
16	2.2.51	17 months.	M.	Rushworth.	Died.
17	2.2.51	41 years.	F.	Merrigum.	Survived.
18	3.2.51	7 years.	M.	Strath Creek.	Died.
19	4.2.51	11 years.	M.	Yea.	Survived.
20	4.2.51	30 years.	F.	Ouyen (?).	Survived.
21	4.2.51	3 years.	F.	Barmah.	Died.
22	4.2.51	7 weeks.	M.	Horsham.	Survived.
23	6.2.51	3 years.	M.	Strathmerton.	Died.
24	6.2.51	10 years.	F.	Nyah.	Died.
25	8.2.51	4 years.	M.	Barham, N.S.W.	Survived.
26	9.2.51	8 months.	F.	Kerang.	Survived.
27	10.2.51	68 years.	M.	Corowa, N.S.W.	Died.
28	10.2.51	12 years.	F.	Speed.	Died.
29	12.2.51	31 years.	F.	Wentworth, N.S.W.	Died.
30	12.2.51	2 years.	F.	Birdwoodton.	Survived.
31	16.2.51	65 years.	M.	Nathalia.	Survived.
32	17.2.51	4 years.	M.	Merbein.	Survived.
33	18.2.51	41 years.	M.	Shepparton.	Died.
34	19.2.51	41 years.	M.	Kyneton.	Survived.
35	22.2.51	5 years.	M.	Ouyen.	Survived.
36	23.2.51	43 years.	M.	Cullulleraine.	Survived.
37	27.2.51	6 years.	M.	Devenish.	Survived.
38	1.3.51	6 years.	M.	Calivil.	Survived.
39	16.3.51	51 years.	F.	Devenish.	Died.
40	12.4.51	6 years.	F.	Kerang.	Survived.

Age and Sex Distribution.

The age distribution of cases is further illustrated in Figure I, which also shows the deaths in this series. Of the 40 patients, 23 were under twelve years of age, and of these nine died. The death rate was only slightly higher in patients over twelve years of age.

There were 28 males and 12 females.

Regions of Infection.

Figure II shows the region where each of the patients is believed to have contracted infection. The distribution of cases is approximately the same as the distribution of population in the areas of irrigation along the south bank of the Murray River. The morbidity rate in the Mildura area (population 30,000) in north-western Victoria is somewhat higher than the average morbidity rate for the rest of that portion of the Murray Valley area of Victoria which lies approximately within fifty miles of the Murray and lower Goulburn Rivers (population 150,000).

In considering the distribution of regions of infection in Figure II two facts should be appreciated. Firstly, the Murray Valley, including the valleys of the tributaries of the Murray River, embraces most of the northern two-thirds of Victoria and most of the western three-quarters of New South Wales. The valley is limited on the east by a chain of mountains running north and south through New South Wales and terminating in the Australian Alps, on the Victorian border. The valley is limited on the south by the Great Divide, a watershed which extends south and then west from the Australian Alps, to reach western Victoria. The Murray River, after leaving the Victorian border, traverses the south-east corner of South Australia.

Secondly, these 40 patients were probably all infected north of the Great Divide, in Victoria or in the immediately adjacent river towns of New South Wales. While there is a fair assurance that no cases of the disease occurred south of the Divide in Victoria, we have no indication of how extensive Murray Valley encephalitis may have been further north of the Murray River in New South Wales. One case of viral encephalitis in South Australia, almost certainly Murray Valley encephalitis, has been reported by Miles, Fowler and Howes. From a fatal case at Narrabri on a branch of the upper Darling River in New South Wales, a similar virus was isolated, as reported in another place by Garven and French. We have had clinical and serological evidence suggestive of three cases in south and central New South Wales, through the cooperation of Dr. W. Kirkland and various practitioners in the regions concerned. These cases were reported from the hospitals of Griffith, Hillston and Forbes, all on the Lachlan River. It is believed that there may have been more cases of Murray Valley encephalitis in New South Wales than those which came to our notice.

A later report will discuss the possibility that Murray Valley encephalitis is endemic as far north as Cairns, in northern Queensland, and perhaps New Guinea and as far to the north-west as the Gulf of Carpentaria.

The Incubation Period.

In a later paper of this series it is shown that infection with Murray Valley encephalitis is very rarely, if ever, acquired south of the Great Divide in Victoria. This finding allows an assessment of the incubation period in circumstances where patients have developed the disease in Melbourne after returning from northern Victoria. Table II gives relevant details of seven cases. On the basis of the first six cases the incubation period would probably vary between one and three weeks. Cases 18 and 19 provide particularly valuable evidence in this respect.

The clinical history of Case 20 is given in a subsequent paper. The patient's illness was complicated by a previous history of psychological imbalance, but there seems little doubt that her current illness was in part an encephalitis. If this encephalitis was due to Murray Valley encephalitis virus, the incubation period was greatly prolonged—at least eight weeks. It is considered irrelevant that the patient's relatives from Ouyen in northern Victoria were staying with her in Melbourne from early January until one day before the onset of her illness.

The Identity of Murray Valley Encephalitis.

Prior to 1951 severe epidemic encephalitis in humans occurred in Australia during 1917 and 1918, when it was described by Cleland, Campbell and Bradley as Australian "X" disease. The outbreaks occurred in Broken Hill and in the river towns of western and central New South Wales. It is recorded that reports were received of a small outbreak at this time in the Goulburn Valley of Victoria, which is within the Murray Valley area. Australian "X" disease involved 70 people with 39 deaths in 1917 and 58 people with 46 deaths in 1918. A few sporadic cases were reported in 1922 and 1925. In 1917 Cleland *et alii* were able to transfer the infection to monkeys, sheep and a horse, using human brain as initial inoculum. Cleland's virus was not retained for comparison with more recent strains of encephalitis viruses. It will never be possible to identify his virus with certainty, but it seems very probable that it was the same agent which we now describe as Murray Valley encephalitis virus.

The clinical and pathological descriptions of Australian "X" disease tally with those of Murray Valley encephalitis. The epidemiological features are remarkably similar. Both

diseases occurred during the first four months of the year, both had a scattered and low morbidity, but both carried a similarly high mortality. The age incidence of Australian "X" disease, two patients in three being under ten years of age, is again comparable with that of Murray Valley encephalitis.

Summary.

During January, February and March, 1951, an outbreak of severe human encephalitis occurred in the Murray Valley in northern Victoria.

The disease has been designated Murray Valley encephalitis.

There were 40 recognized cases and 17 deaths.

The morbidity was higher in children than in adults, and higher in males than in females.

The incubation period was about one to three weeks, but varied between cases.

Clinically and epidemiologically the 1951 outbreak closely resembled Australian "X" disease, which occurred in 1917 and 1918.

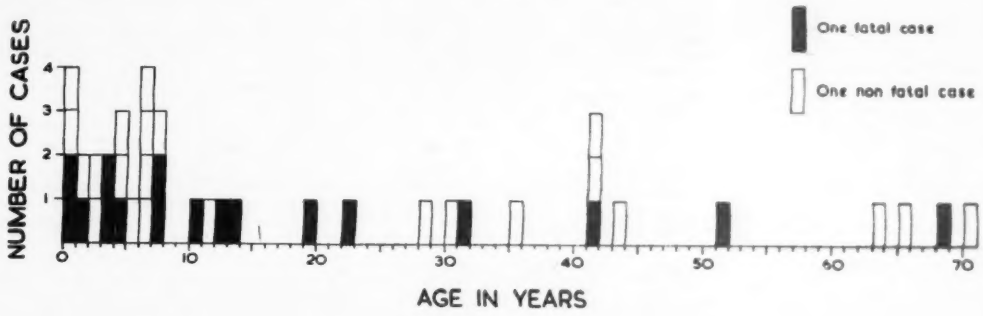

FIGURE I.

Other types of viral encephalitis have been studied overseas, principally in the United States of America, since the First World War. Japanese B encephalitis is widely distributed through Japan, Korea, and the islands south of Japan, but does not occur in the United States of America. A close relation, however—the St. Louis virus) has been responsible for epidemic human encephalitis in the United States of America. Western and eastern equine encephalomyelitis are occasionally responsible for human epidemics in northern America. These encephalitis viruses are believed to be capable of transmission by mosquitoes of the appropriate types, and to be endemic in wild or domestic birds (Reeves, 1951).

FIGURE II.

Early *in vitro* serological studies by Mr. E. L. French, using Murray Valley encephalitis antigen, Murray Valley encephalitis antisera and Japanese B antisera, suggested that Murray Valley encephalitis was closely related to Japanese B encephalitis. The Japanese B serum used in this work was kindly made available by Dr. J. L. O'Connor, of the Commonwealth Serum Laboratories, Melbourne. Further and more accurate identification of Murray Valley encephalitis in these laboratories was not possible at that stage, because of the quarantine restrictions on the importation of encephalitis viruses from overseas. Therefore, Murray Valley encephalitis virus was sent to Colonel J. E. Smadel, of the Army Medical Centre, Washington, D.C., United States of America, with a request that he identify it.

TABLE II.

Information Defining Incubation Period of Murray Valley Encephalitis in Seven Cases During 1951.

Case Number.	Date of Onset.	Dates of Residence in Murray Valley.	Limits of Possible Incubation Period.
8	20.1.51	14.11.50– 1. 1.51	66–19 days.
12	24.1.51	24.12.50–16. 1.51	31– 8 days.
13	26.1.51	10.1.51–	16– 0 day.
18	3.2.51	19.1.51–21. 1.51	15–13 days.
19	4.2.51	27. 1.51–29. 1.51	8– 6 days.
26	9.2.51	12. 1.51– 2. 2.51	28– 8 days.
20	4.2.51	12.11.50– 7.12.50	84–59 days.

Acknowledgements.

An investigation such as is reported in this series of papers demands the efforts of research workers trained in widely divergent fields. It is also vitally dependent on scores of people not normally engaged in research activities.

It is a very great pleasure to thank all those who in any way contributed to this research project. We would mention in particular Dr. A. J. Metcalfe, Director-General of Health, and the medical officers in charge of Commonwealth Health Laboratories; Dr. G. E. Cole, Chief Health Officer, Victoria, and officers of the Department of Health; Dr. W. Aitken, Dr. H. E. Albiston, Dr. M. Benson, Dr. Lucy Bryce and officers of the Red Cross Blood Transfusion Service; Miss Helen Bowring, Mr. A. Dunbavin Butcher and officers of the Fisheries and Game Department, Victoria; Mr. N. J. Favaloro, Professor E. Ford, Mrs. L. Fraser, Mr. W. Gee, Dr. T. Golab, Dr. K. Gunther, Mr. W. L. Hindmarsh, Dr. W. Kirkland, Mr. G. E. Kitson, Government Statist's Department; Dr. L. Lanyon, Dr. I. Mackerras, Mrs. M. J. Mackerras, Dr. J. A. R. Miles, Dr. D. Oxer, Mr. R. T. M. Pescott, Mr. C. W. Brazenor and Mr. W. Hitchcock of the Melbourne Museum, Mr. N. Stanley, Mr. R. J. Talbot, Mr. R. L. Watts, Mr. J. White, and Dr. M. Wilson.

We are indebted to medical and veterinary officers throughout Australia and New Zealand who obtained a large number of sera for us. The medical superintendents and staff of the major Melbourne hospitals have cooperated enthusiastically with our field teams.

The later stages of the work have been greatly facilitated by the generous gift of a truck fitted for field work from Imperial Chemical Industries of Australia and New Zealand.

Throughout this investigation the advice and criticism of Sir Macfarlane Burnet have been invaluable.

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MURRAY VALLEY ENCEPHALITIS: ISOLATION AND CHARACTERIZATION OF THE ÆTIOLOGICAL AGENT.[1]

By E. L. FRENCH,

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WHEN it became known that cases of encephalitis were occurring in the Murray Valley during January and February of 1951 (Anderson, 1952) efforts to isolate the virus from post-mortem material were immediately initiated. This paper sets out the details of the isolation of the virus causing the outbreak of Murray Valley encephalitis and gives an account of some of the properties of this virus.

Isolation of the Virus.

On February 9, 1951, a limited post-mortem examination was done by Dr. S. G. Anderson, of this institute, on a fatal case (Case 152) of encephalitis occurring at Mooroopna in Victoria. Portions of the brain were taken aseptically, sealed in test tubes and stored on dry ice until brought to Melbourne on the following day.

The specimens were thawed at room temperature and portions of the cerebellum, pons, medulla, basal ganglia and cerebrum were mixed and ground with sterile alundum. Sufficient nutrient broth (pH 7·4) was added to make a 20% emulsion, and this mixture was centrifuged for ten minutes at about 3000 revolutions per minute on a laboratory angle centrifuge. To each 1·0 millilitre of the supernatant fluid 20,000 units of streptomycin and 2500 units of penicillin were added as a precaution against possible accidental bacterial contamination of the brain during the post-mortem examination.

An extensive series of animal and chick embryo inoculations were then undertaken with this material. The only positive result was obtained from chick embryos inoculated by the chorio-allantoic method, and it is unnecessary to do more than provide a list of the animals inoculated unsuccessfully. These comprised: two *Macacus rhesus* monkeys inoculated intracerebrally; three adult and six one week old rabbits inoculated intracerebrally, one adult rabbit intratesticularly; two guinea-pigs inoculated intracerebrally and two intraperitoneally; groups of day old and three weeks old mice inoculated both intracerebrally and intraperitoneally; twelve young rats inoculated intracerebrally. No symptoms and, in the case of the larger animals, no significant temperature changes were observed over a period of one month from the time of inoculation.

Developing chick embryos were inoculated using the techniques described by Beveridge and Burnet (1946). Six eleven day old embryos were each inoculated with 0·05 millilitre onto the chorio-allantoic membrane, a similar number of eleven day old embryos were inoculated suballantoically and six five day old embryos were inoculated via the yolk sac. After three days' incubation at 35° C. the chick embryos inoculated on the chorio-allantoic membrane were opened and examined. On several of the membranes one or two spots were noted as being suspiciously like virus lesions. These membranes were ground with sterile alundum and suspended in broth. Penicillin and streptomycin were added to the centrifuged supernatant fluid and the material was inoculated onto the chorio-allantoic membrane of further eleven day old chick embryos. After forty-eight hours' incubation at 35° C. the eggs were opened and about 40 to 50 pocks were found on each membrane. Anaerobic and aerobic cultures were made from the membranes; all remained sterile and it was concluded that a virus had been isolated on the chorio-allantoic membrane. Embryos inoculated with the original material by the other routes showed no gross evidence of infection.

In summary, then, an infective agent giving lesions on the chorio-allantois of typical virus character was isolated from the brain of a fatal case of encephalitis. In view of the fact subsequently established that the virus was highly pathogenic for mice, it is noteworthy that only on the chorio-allantois was isolation successful. This would indicate: (*a*) that very little free virus was present in the post-mortem material, whether due to the presence of antibody or some other reason is not clear; and (*b*) that under such conditions the chorio-allantoic method is the more sensitive detector of virus.

The evidence that this virus is the ætiological agent of Murray Valley encephalitis will be found elsewhere in this paper and in the other papers of the present series. For convenience it will subsequently be referred to as MVE virus (strain 1).

Properties of the Isolated Virus.

Growth of the Virus in Chick Embryos.

The virus could be readily maintained by serial passage every two days on the chorio-allantoic membranes of eleven or twelve day old chick embryos. When incubation of the embryos was continued beyond forty-eight hours, death of the embryo almost uniformly occurred within the next twenty-four hours.

The dead and dying embryos presented a characteristic appearance. There was considerable œdema of the skin with hæmorrhages into the feather follicles, particularly over the head and along the wings. Hæmorrhage into the ventricles of the brain could frequently be demonstrated and histologically there were widespread degenerative and inflammatory lesions in the embryo brain. A striking feature in some infected embryos was the presence of gross hæmorrhage at the extreme tip of the toes.

The focal lesions on the chorio-allantoic membrane had the characteristics of virus lesions in this situation and closely resembled those produced by an adapted influenza virus. After two days' incubation at 35° C. they showed a thickened area of proliferated and necrotic cells about 0·5 millimetre in diameter, with a light surrounding halo of mesodermal infiltration. With more concentrated inocula an almost confluent sheet of fused pocks was obtained, giving the membrane a grey hazy appearance.

Sections made from infected chorio-allantoic membranes revealed that the pocks were produced by ectodermal proliferation and infiltration of inflammatory cells in the mesodermal layers.

[1] This work was aided by a grant from the National Health and Medical Research Council, Canberra.

[2] The case numbers quoted here correspond with those recorded in the first paper of this series.

No inclusion bodies could be demonstrated in these lesions, despite the use of several methods of staining.

Inoculation of chick embryos of various ages intra-amniotically, suballantoically or via the yolk sac with the virus resulted in death of the embryos with the characteristic appearances described above. Considerable quantities of virus could be found in the various fluids and tissues of the embryo after inoculation by any route. Infectivity titrations of these fluids and tissues were carried out on the chorio-allantoic membrane of eleven day old chick embryos, and titres of the following orders of magnitude were obtained: amniotic fluid 10^8, allantoic fluid 10^4, embryo liver, heart and brain each 10^5. Infected chorio-allantoic membranes usually had a titre of 10^6 per gramme.

Experimental Infection in Mice.

After two chorio-allantoic membrane passages the virus in the form of a 10% suspension of infected membrane in broth was inoculated intracerebrally into three weeks old mice. After five days the animals appeared to be sick, presenting a characteristic clinical picture. The earliest sign recognized was a coarse flicking of the ears, which was most marked after the mouse had been twirled about its long axis by the tail. This treatment often brought on tonic and clonic spasms, and momentary incoordination or rolling which could have been caused by a cerebellar lesion. The condition progressed fairly rapidly and in a few hours most of the mice could be found in an attitude of immobility with their tails held stiffly behind and above their bodies. Some of the mice later developed a Parkinson-like tremor. It was not uncommon to see mice squatting on their hind legs with their head on one side and ceaselessly flexing and extending their forepaws. Often these mice could be observed to begin leaning backwards slowly until they finally toppled over on their back, only to resume immediately their former attitude of sitting on their haunches and moving their forepaws.

Death occurred on the seventh or eighth day after inoculation. Large amounts of virus were present in the brains of mice killed when showing typical symptoms and the virus was readily transmissible in series by intracerebral inoculation in mice. The signs remained generally similar on passage, but the average time of death from large inocula was reduced to six to seven days. Some mice developed a flaccid paralysis of the hind legs not seen in the first two mouse passages. A 10% brain emulsion usually gave a titre by intracerebral inoculation in twenty-one day old mice (0·03 millilitre) 10^4 to $10^5 LD_{50}$. On the chorio-allantois approximately 10 pocks would be produced by 0·05 millilitre diluted 10^{-3} to 10^{-4}. Further serial pasages in mice considerably increased the titre of virus found in the brain.

Mice twenty-one days or older could readily be infected by the intranasal route, but only very rarely did encephalitic symptoms and death follow subcutaneous, intramuscular or intraperitoneal inoculations. Very young animals, one to ten days old, could, however, be regularly infected by intraperitoneal or subcutaneous inoculation, death from encephalitic signs resulting in five to seven days. They were also fully susceptible to intracerebral inoculation.

Infection of Other Animals.

Rabbits: Undiluted 10% suspensions of egg passage and mouse brain passage virus were inoculated into fully grown rabbits intracerebrally, intratesticularly, and onto the scarified cornea. No rise in temperature was detected and no signs of infection occurred in any case. The rabbits developed complement-fixing antibody in about three weeks after the intracerebral and intratesticular injections.

Chickens: Newly hatched chickens between two and four days old were inoculated with about 1000 mouse LD_{50} of the virus. One group was given the virus intracerebrally, the other by the intramuscular route. After four to six days the chickens of both groups died with signs of cerebral involvement. Considerable amounts of virus were found in the brain, spinal cord, blood, liver and spleen of dying chickens and histologically an encephalomyelitis could be demonstrated.

Sheep: A six weeks old lamb was inoculated intracerebrally with about 1000 mouse LD_{50}. The day following the inoculation the animal had a temperature of 104·8° F., which returned to normal (100° to 103° F.) the next day. On the fourth day following inoculation the temperature was 103·4° F. and on the fifth day 105° F. The temperature was normal on the sixth day, but the animal did not eat its food. On the morning of the seventh day it was found dead in a natural recumbent position. It was still warm and could have been dead no more than thirty minutes. A post-mortem examination was undertaken immediately. There was a considerable amount of sterile pericardial fluid and cysts of coccidioides were present in the abdomen. The surface of the brain was somewhat congested. No other abnormality was detected. A small quantity of virus (10^2 per gramme) was recovered from the brain and a fairly widespread encephalitis was demonstrable in sections.

Guinea-Pigs: After intracerebral inoculation guinea-pigs developed a temperature of up to 105° F. (normal 101° to 103° F.) about the fourth to sixth day, returning to normal on the seventh to eighth day. No signs of encephalitis were observed and all guinea-pigs inoculated up to the present have survived. The animals develop complement-fixing and neutralizing antibody (as determined by the intraperitoneal inoculation of serum-virus mixtures in mice two to five days old) following infection with the virus intracerebrally.

Monkeys: The two monkeys that had received the original brain material were bled and their sera shown to be devoid of complement-fixing or neutralizing activity. These two animals were inoculated with the mouse brain passage MVE virus in the following manner:

One (K3) was given about 1000 mouse LD_{50} of MVE virus subcutaneously. No rise in temperature or other sign of illness was detected during the next four weeks. It was therefore decided to inoculate K3 intranasally. Under ether anæsthesia about 10,000 mouse LD_{50} of MVE virus was introduced into each nostril. Six days after inoculation the temperature was 103·9° F. and rose to 104·2° F. on the seventh day. The temperature remained above 103·5° F. until the twelfth day, when it returned to normal. Apart from the rise in temperature, the animal showed no other signs of illness over a period of one month.

It seemed likely that K3 would be immune to intracerebral infection after this treatment and a challenge inoculation of about 1000 mouse LD_{50} of MVE virus was given. The other monkey, K4, that had received the original human brain material was similarly inoculated intracerebrally. K3 showed no rise in temperature or other signs of illness. The control monkey, K4, developed a temperature of 103·6° F. on the sixth day and two days later the first signs of tremor and ataxia were observed. He gradually became somnolent and paralysed, and was killed *in extremis* on the thirteenth day. No macroscopic lesions were evident *post mortem*. A mixture of the cerebellum and cerebral cortex contained 10^6 per gramme of virus when titrated on the chorio-allantois. No virus was detected in the blood.

Examination of Material from Other Cases.

A large number of other attempts were made to isolate virus from cases of Murray Valley encephalitis by the use of cerebro-spinal fluid, blood and throat washings from patients, as well as from central nervous tissue. In the majority of cases the material was sent to the laboratory in sealed tubes on dry ice and was maintained in this state until it could be investigated.

As occasion presented itself, the material was thawed, emulsified, mixed with antibiotics and inoculated onto the chorio-allantoic membranes of six eleven day old chick embryos and intraperitoneally into six five to seven day old mice. The egg membranes were harvested and examined after three days' incubation at 35° C. and passaged to further eleven day old embryos. If no lesions appeared

on these second passage membranes after three days' incubation at 35° C. then a negative result was recorded. The mice were observed for a period of three weeks and then discarded if no illness had developed.

The results with material obtained before death were all negative. Two additional isolations of virus were made from central nervous tissue. No virus was isolated from the remaining fourteen fatal cases of the disease, despite attempts in both chick embryos and mice. The second isolation was made from pieces of brain kindly sent by Dr. Alison Garven, of the Royal Alexandra Hospital for Children, Camperdown, New South Wales. A suspension of cerebral cortex, basal ganglia, medulla, pons and cerebellum was inoculated into twenty-one day old and two to four day old mice intracerebrally and also onto the chorio-allantoic membrane of eleven day old chick embryos. Virus was isolated on the chorio-allantoic membrane from each specimen of brain, between two and fifteen pocks being produced on the primarily inoculated membranes. Twenty-one day old mice inoculated intracerebrally with basal ganglia, pons and cerebellum, and two out of five two to four day old mice inoculated with cerebral cortex died with encephalitis. All mice inoculated with medulla failed to show any illness. In this instance, therefore, virus was isolated on the chorio-allantois from all five pieces of brain examined, from three out of five pieces in twenty-one day old mice and from four out of five pieces in two to four day old mice. The third isolation, like the first, was successful only on the chorio-allantois (Case 24).

The identity of both viruses isolated with MVE strain 1 was shown by demonstrating that complement-fixing antigens prepared from infected egg membranes reacted similarly with positive and negative guinea-pig test sera.

Serological Reactions with Murray Valley Encephalitis Virus.

In the special circumstances of the outbreak it was regarded as urgent that effective serological tests should be elaborated as soon as possible. For serological survey work a complement-fixing reaction was particularly desirable and immediate efforts were made to prepare a suitable antigen by a simpler method than the rather elaborate one used by Casals (1949) to prepare antigens from mouse brains infected with various neutrotropic viruses. After a few experiments the following technique was adopted with very uniform results.

Ten day old eggs are inoculated on the chorio-allantoic membrane with a 10^{-3} dilution of mouse brain from the fifth mouse brain passage from the second egg passage. After forty to forty-two hours' incubation at 35° C. the infected membranes are harvested and ground with sterile alundum together with the drainings from the membranes. The ground mass is mixed with calcium magnesium saline[1] in the proportion of 1·0 millilitre to every ten membranes ground. The mixture is centrifuged for thirty minutes at 3000 revolutions per minute and the supernatant fluid used as the antigen. Uninoculated eggs are similarly treated for the preparation of antigen control.

Antigen prepared in this fashion has proved highly specific and has been used in the test developed by Donnelley, to be reported later, for the survey of human and mammalian sera. Full technical details of the test will be given in Donnelley's paper.

A preliminary exploration of the possible methods of carrying out serum neutralization tests was also undertaken, particularly from the point of view of studying avian sera which are often unsuitable for complement-fixation tests. The conventional method of intracerebral inoculation of virus-serum mixtures in mice was found satisfactory, but owing to the limited supply of mice available two other methods were tested. Burnet's (1939) method of demonstrating neutralization by reduction of pock-count on the chorio-allantois was found to be too insensitive to provide a practical method. Following the observation that baby mice could be fatally infected by intraperitoneal inoculation, it was found that neutralization by specific antibody could be readily demonstrated by inoculating serum-virus mixtures intraperitoneally in four to seven day old mice.

A method based on this principle is being extensively employed at present in the study of avian sera by Dr. S. G. Anderson, and other applications are referred to in the following section.

Immunological Relationship of Murray Valley Encephalitis to Other Encephalitis Viruses.

The clinical and epidemiological picture of the human disease together with the experimental findings reported above made it almost certain that we were dealing with a virus of the arthropod-borne encephalitides group (Hammon, 1943). Owing to restrictions on the importation of viruses into Australia only very limited work could be done on the possible relationship of MVE virus to other types. Essentially this was limited to a comparison with Japanese encephalitis B virus (Nakayama strain) received from Dr. J. L. O'Connor, who also kindly supplied hyperimmune guinea-pig serum. A commercial complement-fixing antigen for Japanese encephalitis B was also obtained from Lederle Laboratories.

Complement-fixation tests with the use of pre-inoculation and immune guinea-pig sera were carried out, the highest serum dilution giving 50% fixation with optimal antigen concentration being taken as the end point. Full controls were included. Apart from the fact that the Murray Valley encephalitis antigen gave a much higher titre with both the Murray Valley encephalitis and Japanese encephalitis B sera than did the commercial Japanese B antigen, no significant difference between the two viruses could be detected in this test.

Comparative neutralization tests with use of the hyperimmune monkey serum K3 were made against both viruses by the baby mouse method described above. Pre-inoculation and immune sera from K3 were heated at 56° C. for thirty minutes and mixed undiluted with equal volumes of virus dilutions in broth. The mixtures were inoculated intraperitoneally in groups of six mice, four to seven days old (0·03 millilitre per mouse). The mice were kept under observation for twenty-one days. Unfortunately complete end points were not obtained in this test, but the results suggested that the K3 immune serum neutralized approximately 100 times more Murray Valley encephalitis virus than Japanese encephalitis B virus. Further reagents are being prepared to investigate the relationship between these two viruses more thoroughly. The results obtained so far seem to indicate that Murray Valley encephalitis and Japanese encephalitis B viruses are related but not identical.

Discussion.

The evidence that the virus described in this communication is in fact the ætiological agent of the 1951 epidemic of Murray Valley encephalitis may be stated briefly as follows. It has been isolated from three typical cases of the disease in this laboratory and a fourth strain serologically similar to our strains has been described by Miles, Fowler and Howes (1951); in four instances specific antibody absent early in the illness has appeared in the blood at a later stage; only in one instance has test of a patient's serum at an appropriate time after typical illness failed to show antibody in the blood (Anderson *et alii*, 1952). Finally, the present investigations show that the virus has characteristics closely resembling those viruses that have been shown to cause human disease in other countries, notably the viruses of Japanese encephalitis B and St. Louis encephalitis.

Perhaps the most important single feature of the present paper is the demonstration of the usefulness of the developing chick embryo as a means of isolating this virus. The chorio-allantoic route of inoculation was first described

[1] Calcium magnesium saline was modified from the formula published by Mayer, Osler, Bier and Heidelberger (1946) as follows: Sodium chloride 8·5 grammes, anhydrous calcium chloride 0·0275 gramme, magnesium chloride (crystalline) 0·192 gramme, boric acid (crystalline) 1·203 gramme, sodium borate (crystalline) 0·052 gramme in distilled water 1·0 litre.

as a technique for growing viruses by Woodruff and Goodpasture (1931). It was extensively used in this institute for studying the epidemiology of influenza in the days before hæmagglutination techniques were developed, and for the isolation and study of herpes, vaccinia, ectromelia and several other viruses. The isolation of the Murray Valley encephalitis virus on the chorio-allantoic membrane is, as far as we are aware, the first instance of the primary isolation of a hitherto unrecognized virus from human disease by this method. Furthermore, two of the isolations in the present series were effected only by this technique, the more usual mouse inoculation failing completely. In this connexion it is of interest to note that we have been unable with this virus to carry out neutralization tests on the chorio-allantoic membrane in the manner used with herpes and vaccinia viruses. On the other hand, mouse neutralization tests are readily performed. It seems not unlikely, therefore, that when a specimen of human brain is inoculated into mice, sufficient antibody may in some cases also be present in the inoculum to prevent infection by the virus. The same amount of antibody is not, however, sufficient to prevent the initiation of infection on the chorio-allantoic membrane.

The preparation of complement-fixing antigen from infected chorio-allantoic membranes eliminated the tedious and more difficult extraction techniques employed with the commonly used mouse brain antigens. An antigen prepared by this simple technique has been successfully used throughout the extensive epidemiological surveys reported in an accompanying paper (Anderson *et alii*, 1952). Furthermore, once suitable reagents from the first strain had been prepared, it was only necessary to prepare similar egg membrane antigens from the second or third egg passage of any new strain to allow its serological identity to be determined.

From the limited material available in Australia tests indicate that Murray Valley encephalitis virus is related to, but possibly not identical with, Japanese encephalitis B virus. Its exact relationship to the other members of the group of arthropod-borne encephalitis viruses can be determined only by cross-neutralization tests with other members of this group. The Murray Valley encephalitis virus has been sent to Colonel J. E. Smadel, Chief of the Department of Virus and Rickettsial Diseases, Army Medical Service Graduate School in Washington, United States of America, for study along these lines.

Summary.

1. From an outbreak of severe encephalitis a virus has been isolated from the brains of two cases from northern Victoria and also from a third case occurring in northern New South Wales.

2. The virus was more readily isolated on the chorio-allantoic membrane of developing chick embryos than by inoculation into mice.

3. A simple method of preparing complement-fixing antigen from infected chorio-allantoic membranes is described.

4. The virus is serologically related to, but not identical with, the virus of Japanese encephalitis B and resembles this virus in its host range and other laboratory characteristics.

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MURRAY VALLEY ENCEPHALITIS: CLINICAL ASPECTS.

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THE distinctive clinical features of severe encephalitis enabled practitioners in the Murray Valley regions to recognize early in the outbreak that an unusual type of illness was occurring. Following the isolation of the virus and the development of a specific complement-fixation test the clinician was provided with a means by which infection by the virus could be more definitely recognized, and equally important by which otherwise similar illnesses could be excluded from the group. The manifestations of the disease are protean in character, reflecting the diffuse infection of the nervous system. In view of this, and for the purpose of this paper, only those cases have been chosen for description which illustrate the major clinical types.

In general the illness commenced abruptly with malaise, anorexia, headache, fever, lethargy and drowsiness with irritability, vomiting, giddiness and, especially in younger patients, convulsions. Subsequently cerebration and consciousness became progressively impaired. In adults this development was often gradual; in children a rapid progression was commoner. Cervical rigidity was constant and the number of cells in the cerebro-spinal fluid was moderately increased. Improvement might commence at any stage, and, if it began early, recovery was rapid and complete. More frequently the disease progressed, with the appearance of involuntary movements of various types, deep unconsciousness, upper and lower motor neuron paresis, inability to swallow, and respiratory dysrhythmia. A number of the patients who developed this severe condition survived, some with considerable impairment of cerebral function. Many, however, died.

The manifestations varied in infants, children and adults; hence these groups may be separated for detailed description.

The Disease in Infants.

Four patients who developed the disease in the first nine months of life were examined. The youngest patient (Case 22[1]) developed the disease at the age of seven weeks, the others at three, five and eight months (Cases 1, 4 and 26). In all cases Murray Valley encephalitis complement-fixing antibodies were present in the sera taken at a later stage of the disease.

The mildest case in this group is described first. This was one of the four cases in which serum in the acute

[1] The case numbers quoted here correspond with those recorded in the first paper of this series.

stage was negative and in which Murray Valley encephalitis antibody was developed during convalescence.

CASE 26.—A baby girl, eight months of age, lived in Melbourne, but had spent three weeks at Kerang, leaving there on February 2, 1951. Her mother stated that on February 10 she awakened and grizzled just after midnight. She went off to sleep almost immediately, but awakened crying for two further brief intervals. She refused her 6 a.m. bottle, and at 10 a.m. she took a little jelly, but would not take milk. She vomited shortly afterwards. During the day she lay flat on her back, quite motionless and sleeping most of the time. When she was lifted she whimpered and hunched her shoulders around her dorsi-flexed head. Although she resented disturbance she seemed too weak to cry. She refused the remaining feeds, and vomited again in the evening. At 8 p.m. her whole body was convulsed for a few seconds. A short time afterwards she became comatose, ceased breathing and became very blue. She lay inert all night, too weak to move. In the morning she stood up in her cot and took her 6 a.m. bottle. At 7.45 a.m. she commenced to scream and seemed hotter than before. She resented being touched and refused further food.

She was admitted to Fairfield Hospital on the second morning of her illness. Her temperature remained high for six days, reaching 105° F., and then slowly subsided. The morning temperature was not infrequently higher than that in the evening. The pulse rate was between 120 and 130, the respirations were usually between 32 and 40 during the early days, and once when the temperature was 101° F. the respiratory rate was recorded as being 64. There was marked cervical and spinal rigidity. The deep reflexes were equally active, the abdominal reflexes were absent and the plantar reflexes flexor. The cerebro-spinal fluid contained 330 lymphocytes and six polymorphonuclear cells per cubic millimetre, and 40 milligrammes *per centum* of protein. On the fifth day the temperature was subsiding and the child was less irritable. The stiffness of neck and spine remained severe. There were 380 cells in the cerebro-spinal fluid, 63% being lymphocytes and 36% polymorphonuclear cells. The protein content was now 80 milligrammes *per centum*, sugar 40 to 50 milligrammes *per centum* and chlorides 710 milligrammes *per centum*. The leucocyte count was 29,100 per cubic millimetre (neutrophile polymorphonuclear cells 50%, large mononuclear cells 4%, large lymphocytes 40%, small lymphocytes 6%).

On the eighth day the cells in the cerebro-spinal fluid had fallen to 80 per cubic millimetre (56% polymorphonuclear cells and 44% lymphocytes) and the protein had risen to 200 milligrammes *per centum*. On the ninth day the head was rotated to the right, the right side of the face moved less than the left, and the right arm was held in extension and seemed stiffer than the left. On the twelfth day the cerebro-spinal fluid contained 120 cells per cubic millimetre, polymorphonuclear cells and lymphocytes being in equal proportions. The protein content was 100 milligrammes *per centum*. The leucocyte count had fallen to 6300 cells per cubic millimetre (neutrophile polymorphonuclear cells 33%, eosinophile cells 1%, basophile cells 1%, large mononuclear cells 40%, large lymphocytes 19% and small lymphocytes 6%). On the fourteenth day the patient was afebrile and the cerebro-spinal fluid contained 54 lymphocytes and 46 polymorphonuclear cells per cubic millimetre, the protein content being 110 milligrammes *per centum*, sugar 40 to 50 milligrammes *per centum* and chlorides 725 milligrammes *per centum*.

On the seventeenth day the child was able to hold up her head and on the eighteenth day no abnormal signs were detected. However, when she returned home her parents noticed that she did not use her right arm and leg as much as the left. She took a long time to settle down at night, and frequently awakened screaming, as if she had had a nightmare. She was very hard to manage, and if thwarted she flew into a temper. During the sixth week her parents noticed quite frequently that she would sit still and stare for a few seconds. In the longest such attack she became very pale, and wanted to lie down after it had passed. At the end of the seventh week she was regaining her ability to crawl and appeared to be using her limbs equally.

The three other infants of this group suffered more severely. One, a boy of seven weeks (Case 22) survived, but was severely incapacitated, vegetative, blind and deaf, with flaccid immobile limbs and equivocal plantar responses. The electroencephalogram showed slow high-voltage activity with little correspondence between the tracings from various areas.

The two others of this group of severely affected infants (Cases 1 and 4) died after illnesses lasting for 60 and 93 days, and are described in detail in the subsequent paper.

The Disease in Older Children.

The manifestations in older children were similar to those in infants, but the intensity of cerebral damage and the mortality were less. Also the children were able to describe their symptoms at the onset. The following account is based upon a group of nine patients between the ages of 22 months and 11 years (Cases 2, 3, 13, 14, 19, 21, 23, 30 and 32), which included three fatal cases (13, 21 and 23). The clinical diagnosis was supported by serological tests in seven cases. The remaining two patients died before serological diagnosis was possible. In these a pathological picture which came to be regarded as typical appeared to confirm the diagnosis.

The illness usually commenced with anorexia and malaise, and sometimes the patient complained of feeling cold and shivery. One child felt giddy. Diarrhœa and vomiting were present in two patients at the onset. Vomiting was present in three other cases in the initial phases. The older children all complained of, or gave evidence of, having headache. One patient complained that his legs felt weak and he fell over on the day of onset. Two complained of pains in the limbs and had an extensive macular erythematous rash. Attacks of generalized twitching or stiffness occurred in four cases, and in one of the patients unilateral twitching was also present. Consciousness was impaired in varying degree. Four patients could not be roused from coma, and three could be roused momentarily to irritable response. The other two patients were drowsy, confused and irritable. Periods of restlessness, confusion and sometimes delirium occurred in a number of cases, especially at night, and often when the patient was slowly recovering.

Cervical rigidity was present in all cases and was combined with spinal stiffness in five. Kernig's sign was positive in three cases. Opisthotonus was less common than in infants (being recorded in only two cases). Muscular weakness, hypertonicity, increased deep reflexes, and extensor plantar responses gave evidence of involvement of upper motor neurons in six cases. Sometimes the plantar responses of flaccid lower limbs were extensor. The presence of a lesion of lower motor neurons was suggested by the signs in four cases. The distribution of these motor changes was often asymmetrical and varied from time to time, and when slight the signs disappeared as the patient improved. Muscular control was impaired in a number of ways. Tremor was usually present during voluntary movement, and in two cases there was a moderate degree of ataxia. Nystagmus was usually transient. Involuntary movements occurred in seven cases. These were of varying types—twitching of facial muscles, sucking movement of the lips, choreiform movement of the tongue, coarse twitching of muscles, myoclonic twitching, rhythmical tremor described as resembling that of Parkinson's disease, constant movement of the eyes from side to side, and in two cases prolonged upward deviation of the eyes. Sensory stimuli, such as a sudden noise or touching of the patient's bed, sometimes provoked spasms of rigidity. During recovery movements of the eyes were noticed to be jerky, the closed eyelids showed rhythmical tremor, and voluntary movements of the limbs, especially the arms, were tremulous. Respiratory arrhythmia and acceleration were present in all cases, and especially in all of the patients who died. Transient phases of diaphragmatic and intercostal palsy were noted in two.

Two of the nine severely afflicted patients died on the tenth and eleventh days. Two are vegetative survivors. The patients who survived with much damage show extensive cerebral decadence, with evidence of upper and lower motor neuron damage. In the less severe and slighter cases the patients improved and are regarded as having made good recoveries in from two to five weeks after the onset.

The number of cells in the cerebro-spinal fluid was between 60 and 340 per cubic millimetre. Lymphocytes

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again predominated, although up to 40% of polymorphonuclear cells were counted. The number of cells usually fell as the disease progressed, but sometimes a rise was noted in the early days. The protein content in this group was low, being between 30 and 40 milligrammes *per centum*. There seemed to be no correlation between the number of cells and the severity of the disease.

The Disease in Adults.

The disease in adult patients, for descriptive purposes, may be divided into four groups, of varying severities.

Apart from the mildest cases, ten adults were examined at some stage of, or throughout, their illnesses. In three the illness was slight, in three moderately severe, and four died. Complement-fixation test results were positive in all patients but one, and in one case (Case 15) virus was recovered from the brain.

Mildest Cases.

A number of persons who had lived in the same situation as, and in contact with, patients with proven severe infections suffered from symptoms suggestive of mild encephalitis. While interviewing "contacts" in the Mildura district, Dr. Caldwell obtained accounts of five patients who gave such histories and a number of further cases of the same general character were found. In no case, however, was the patient seen at the time of symptoms, and therefore there is no instance in which it can be said that a mild symptomatic infection took place and was directly associated with the appearance of antibody. Tests for antibody in persons with a past history of suspicious illness gave only a slightly higher percentage of positive results than in unselected individuals from the same district. A number of these illnesses may well have been the result of infection with Murray Valley encephalitis virus, but it should be stressed that the presence of specific antibody discovered in a single test some time after the illness in question does not provide valid evidence that the recent illness was due to the virus.

With these reservations the following three case histories from persons in the epidemic region may be cited as perhaps representing cases of very mild encephalitis.

A young man, nineteen years of age, suffered from frontal headache, vomiting, lethargy and photophobia, with stiffness of the neck and a temperature of 104° F. He improved rapidly over the next few days.

A fruit picker, in an orchard belonging to the father of an encephalitic child, experienced a feeling of contraction of his neck while grape-picking. He felt nauseated and somewhat hazy. His wife stated that he was irritable, unable to concentrate or to stand noise. On the fifth day he had frontal headache, pain in the small of the back and numbness of the buttocks. There was tremor of his hands. Complete recovery quickly followed.

A third patient, a woman of thirty-eight years, suffered bad headache and was restless during the night. Her head throbbed when she vomited. She was free from headache in the morning, and in the afternoon ran in a foot-race at a picnic. Subsequently tremor of the facial muscles was observed. The headache returned during the night and she spent a restless night, staying in bed because of headache and being troubled by light. She noticed pain in the back on moving her head. Four days after the onset the symptoms disappeared.

Case with Typical Clinical Features in which Antibody Failed to Develop.—Brief reference may be made to one patient (Case 17) who developed a typical illness, during the period of the outbreak and in an epidemic area, near Shepparton, but who failed to give serological evidence of infection.

A woman of forty-three years was admitted to hospital having suffered during the previous five days from headache, vomiting, stiffness of the neck, pains in the limbs, and drowsiness increasing to stupor. The highest temperature recorded was 104·4° F. Examination showed generalized hypertonicity, extensor plantar responses and cervical rigidity.

The cerebro-spinal fluid contained 35 cells per cubic millimetre. After passing through a period of confusion and delirium, she had apparently recovered at the end of six weeks. At no stage did the serum contain complement-fixing antibody.

Slight Cases.

Three patients (Cases 10, 36 and 31), aged respectively twenty-eight, forty-three and sixty-five years, fall readily into this group. Each suffered from headache. The headache was usually frontal in location, sometimes occipital. Usually an ache, the pain became of shooting quality on coughing. One patient stated that, when he stooped, the pain gave a kick and then throbbed. Another found that bending down did not alter the headache, but it became terrible, shooting across the forehead, on straightening. Lying down relieved the headache of two patients, and one patient found that severe paroxysms of headache were relieved only by lying prone. One patient described the headache as being nauseating, and one vomited. One patient slept well, the others were awakened by headache, and one was sleepless at night. Each tried to continue with work, but was unable to do so. One felt giddy and was unsteady on his feet. Degrees of lethargy, irritability and restlessness occurred. Two were irrational and one was very difficult to restrain. Memory of the period of headache was vague; each complained that he had lost several days. All patients were able to formulate speech. They were described as being careless in vesical and rectal control.

The temperature was high in all cases (rising between 103·6° and 105° F.). A moderate degree of cervical rigidity was present in all cases. There was tremor on voluntary movement. In one patient the tremor of the jaw and limbs was coarse and rhythmical. His voice was tremulous and difficult to understand. Another patient stuttered more during the illness than before. There was to-and-fro movement of the tongue on protrusion. In two patients seen during convalescence (some ten days and six days after the onset of symptoms) ocular movements showed an abnormality which was seen in a number of other convalescent patients. The movements were full but jerky, and on attaining full lateral deviation oscillatory nystagmus occurred. Upward and downward rotation of the eyes was jerky and jerky movements of the eyelids accompanied downward rotation. Rapid tremor of the eyelids accompanied light closure. One patient had one extensor plantar response. The patients appeared tense, nervous and easily startled.

Moderately Severe Cases.

Of the three patients in this group (Cases 6, 8 and 20), two will be discussed in detail.

CASE 8.—A male patient of sixty-nine years lived in Melbourne, but had returned from a visit to the Murray Valley three weeks before the onset of symptoms. He began to complain of headache, pain in the left hypochondrium, vomiting, and slight diarrhœa. The temperature was 102·6° F. and there was slight abdominal tenderness. He became delirious and was admitted to Saint Vincent's Hospital. His neck was stiff and the deep reflexes were hyperactive. The cerebro-spinal fluid contained 140 cells per cubic millimetre (70% lymphocytes and 30% polymorphonuclear cells). The total protein content was 90 milligrammes *per centum*. On the seventh day tremor and rigidity likened to that of Parkinson's disease were noticed in the arms. His lips and tongue were also tremulous. The temperature gradually fell and the state of consciousness improved, although he remained drowsy. The number of cells in the cerebro-spinal fluid fell to 19 per cubic millimetre (90% lymphocytes) on the fifteenth day, while the protein content had risen to 90 milligrammes *per centum*. He was able to converse and take an interest in his surroundings by the twentieth day, and the rigidity and tremor had disappeared by the twenty-fourth day. On the twenty-sixth day, however, both cells and protein had risen, the values then being 34 lymphocytes per cubic millimetre and 160 milligrammes *per centum*. On the thirty-first day he walked normally. His mentality was clear, but he had no recollection of his severe illness. On the thirty-seventh day he complained of weakness of his right shoulder and on the fiftieth day he stated that his legs gave way underneath him. On the fifty-third day

the cerebro-spinal fluid contained seven cells (three lymphocytes and four polymorphonuclear cells) per cubic millimetre and 240 milligrammes *per centum* of protein. Examination then showed widespread muscular wasting (of supraspinati and infraspinati, deltoids, interosseous muscles, thigh muscles, particularly on the right side), with widespread fibrillation. The deep reflexes were diminished and the superficial reflexes normal. There was no sensory loss.

These findings indicated the presence of a rapidly progressive lesion of anterior horn cells—much more rapid than the usual type of progressive muscular atrophy.

CASE 20.—A woman of thirty years complained of severe headache, as if her forehead was lifting up and down. She was unable to lift her head from the pillow, and when she did so she vomited. She became confused and drowsy. After admission to hospital she remained irritable, uncooperative, irrational, sometimes tearful, prone to wander unclothed into the corridors. On the twenty-second day the left pupil was smaller than the right and reacted less briskly to light and to accommodation than the right. The direct and consensual corneal reflexes to the right eyelids were diminished, and there was a moderate degree of weakness of the upper and lower facial muscles on the right side. The grip of the left hand was weaker than that of the right. The reflexes showed little abnormality. There was still slight cervical rigidity. She was able to speak throughout and was sometimes incontinent. On the seventeenth day the cerebro-spinal fluid contained 52 lymphocytes per cubic millimetre and 300 milligrammes *per centum* of protein.

At the end of forty-six days the patient was still confused and irrational, although able to cooperate in neurological examination and to answer simple questions reasonably. The persistent abnormality of cerebration suggested lasting cortical involvement. However, the patient had been depressed and tearful for some time after her pregnancies, and a sister had suffered a severe nervous breakdown. The possibility of a psychogenic component suggested that recovery might be better than would be otherwise expected.

The third patient in this group (Case 6) presented an unusual diagnostic problem. He was known to suffer from chronic nephritis and hyperpiesis. Headache and vomiting and confusion deepened into coma on the fifth day. There was cervical rigidity and Kernig's sign was present; the blood pressure was systolic, 215 millimetres of mercury and diastolic, 135 millimetres. The cerebro-spinal fluid then contained 75 lymphocytes and five polymorphonuclear cells per cubic millimetre and 75 milligrammes *per centum* of protein. On the seventh day the cerebro-spinal fluid was brightly and evenly blood-stained. The right limbs were weak, the plantar response being extensor, and later reflex grasping was present. The amount of blood in the cerebro-spinal fluid rapidly diminished, and the fluid was xanthochromic for twenty-five days. The protein content reached 300 milligrammes *per centum*. Subsequently he improved slowly. The complement-fixation test gave a positive result.

Fatal Cases in Adults.

A close clinical study was made of four patients whose ages ranged from nineteen to sixty-eight years and who died in the adult group. The youngest patient (Case 15) was admitted to hospital five days after the onset and died on the thirteenth day. His history and pathological findings are of especial significance, for it was this patient from whom virus was recovered. A patient of forty-one years (Case 33) was admitted to hospital twenty-four hours after the onset and died on the tenth day. The oldest patient (Case 27), of sixty-eight years, was admitted to hospital on the third day and died on the twelfth day. His serum, which was "negative" in the acute phase, developed Murray Valley encephalitis antibody before death. The remaining patient (Case 9), aged twenty-two years, died on the thirty-fourth day.

The onset was accompanied by generalized bodily aches and pains in two patients. Two complained of a feeling of profound weakness and fell over on attempting to rise. Headache was severe in all patients and three vomited. After a period of irrational disorientation one patient became profoundly unconscious on the second day. The others lost consciousness more slowly, passing through a stage of irritable stupor. Cervical rigidity was present in all and Kernig's sign in two.

In one patient the pupils were small and reacted feebly to light. There was bilateral ptosis when the patient was awake, and the right corner of the mouth was blown out with respiration when he became comatose. No definite ocular palsies were observed in any of these patients. In two the eyes were described as roaming in parallel fashion. Not infrequently the eyes were wide open and apparently observant. Two patients (Cases 9 and 15) had intermittent attacks of tremor. Fine tremor began in the arms and rapidly increased to coarse rapid shaking of the whole body, which lasted for a few minutes. One of these patients started violently in response to noise, and this was followed by an attack of shaking. Both patients showed, in addition, tremor which resembled that of Parkinson's disease. In one there was more or less rhythmical, but somewhat irregular, flexion of fingers and thumb with pronation and supination of the forearm. There was also continuous rhythmical tremor of the lips. In both patients passive manipulation encountered resistance which seemed more or less equal whatever the direction of the movement, and a cogwheel element was sometimes evident. In another patient (Case 33) there was cogwheel rigidity of the left arm, with slight tremor when the arm was disturbed, and intermittent spasmodic tremor of the right arm. Myoclonic twitching and fine fibrillation were noticed in one patient. The remaining patient (Case 27), during stages of restlessness, made intermittent sucking movements with his lips, with erratic movements of his limbs, which were somewhat tremulous. This patient showed right facial paralysis at a later stage, blowing out the corner of the mouth during stertorous expiration. The deep reflexes were poor in two, unequal in one, and exaggerated in the fourth patient. The plantar responses were flexor in the last mentioned and in one other patient, and extensor on one or both sides of the other two patients. Three patients showed temporary improvement before the final stage of bulbar failure.

Respiratory difficulties were present at an early stage in the fatal cases. One patient (Case 33) breathed periodically on the second day of illness. Subsequently moist sounds were heard in the lungs. On the fourth day Cheyne-Stokes respiration was recorded. The patient subsequently improved, became able to articulate "yes" and "no" and attempted to sit up. However, on the tenth day he became cyanosed with gasping respiration. In spite of an attempt at postural drainage and suction, large volumes of brownish fluid continued to run from his mouth. After becoming very slow and irregular, respiration ceased. Another patient (Case 15) was put in a respirator on the seventh day, because of poor breathing. After an hour respiration was normal again. Two days later artificial respiration was again necessary, with subsequent improvement. After an attack of severe twitching he became more deeply unconscious for twenty-four hours, but subsequently he was able to articulate for two days. However, he was unable to swallow. Finally he became cyanosed and died within four hours of respiratory and cardiac failure.

In a third patient (Case 27) the decline after temporary improvement was thought to be due to pneumonia. By the tenth day the temperature had fallen and the patient was commencing to respond to commands and reply to simple questions. The temperature then rose to 102·2° F., and moist sounds were heard in the chest. The patient died two days later. At autopsy the lungs showed no consolidation, but microscopically patches of infiltration with inflammatory cells were seen in the parenchyma, with some invasion of alveoli.

The remaining patient (Case 9) appeared to be taking a little notice of his surroundings on the tenth day, but again he lapsed into coma. His temperature failed to fall in the usual fashion, still reaching 102° F. at the end of two weeks, then fluctuating between 99° and 103° F. for a further period of two weeks, to rise to 104·6° F. during the last three days.

The cerebro-spinal fluid and the leucocyte count showed no unusual features, although unfortunately no record exists of the terminal stages.

Thus these patients appeared to have suffered from more than usual involvement of the basal ganglia and of respiratory control centres. In spite of the râles to be

heard over the chest, only slight pneumonic consolidation was demonstrated *post mortem*. Possibly inhalation accounted for some of the inflammatory disease in the lungs, although in most cases care had been taken in tube feeding, suction and posturing of the patient.

Summary.

A clinical description is given of Murray Valley encephalitis based on a study of four babies of whom two died, nine children of whom two died, and thirteen adults of whom four died.

The disease generally took a more rapid course in younger patients, but was an acute episode at any age.

The symptoms and signs found at all ages were typical of the general picture of an acute viral encephalitis, and did not allow the disease to be clinically distinguished from the other viral encephalitides common overseas—Japanese B encephalitis, St. Louis encephalitis, and human infections with western and eastern equine encephalomyelitis—nor from the cases of Australian X disease reported in 1917 and 1918.

Acknowledgement.

We wish to express our gratitude to the practitioners in the Murray Valley district and in Melbourne who have so generously allowed the examination of patients under their care. We feel an especial debt to Dr. M. Benson and Dr. L. H. Lanyon, medical superintendents of the Mooroopna and Mildura Base Hospitals.

MURRAY VALLEY ENCEPHALITIS: PATHOLOGICAL ASPECTS.

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THE following account is a preliminary report, published at this stage in order that one facet will not be lacking from the initial reports on Murray Valley encephalitis. The material described was obtained from patients affected in the outbreak in the Murray Valley, Australia, during January, February and March, 1951.

Material.

Eight brains and two spinal cords of patients who presumably died of Murray Valley encephalitis have been examined macroscopically and microscopically. In two instances pieces of tissue only have been examined. In all instances save one blocks of tissue had been removed for viral examination; hence study of the basal ganglia and mid-brain was incomplete.

Acute Stage.

Material from seven patients (Cases 13, 15, 16, 23, 24, 27 and 33) who died between the ninth and thirteenth days of the disease was examined. Virus was recovered from two brains (Cases 15 and 24). Murray Valley encephalitis complement-fixing antibody was present in the sera of three others (Cases 16, 27 and 33), but was not detectable in the sera of the remaining two. In these two, however, serum was obtained on the fifth day, before a positive result might have been expected.

Macroscopic Appearance.

The superficial vessels were congested. The pia-arachnoid was slightly opaque and irregularly infiltrated with blood. The congestion and hæmorrhage were probably due to the mode of death rather than to the disease itself. Small vessels were slightly more apparent in the white matter of the cerebral hemispheres than in normal material, and the surrounding brain was sometimes stained with blood. Again, this was not more marked than in patients dying with venous congestion. In one specimen the ependyma of the lateral ventricles appeared somewhat milky and some blood was present.

The brains otherwise appeared normal, save for some patchy degeneration of cerebellar folia in one patient who died on the tenth day. The grey matter of the spinal cord appeared pinker than normal in the two cases examined.

Microscopic Appearance.

The most obvious changes to be seen on initial inspection were, in order of obtrusiveness, firstly, infiltration of the pia-arachnoid with inflammatory cells, secondly, disappearance of Purkinje cells, and thirdly, focal accumulations of reactive cells throughout the grey matter of the nervous system. The neuronal involvement and reactive changes together with their distribution deserve further description.

Neuronal Changes, Nature and Distribution.—In the acute stages there was generalized involvement of neurons, although this was unexpectedly slight in the cerebral cortex. In a number of cells the nuclei were eccentric and the Nissl material was fragmented or clumped, leaving clear areas in the cytoplasm. No neuronophagia was seen. On the whole, the thalamic neurons were more involved, although the degree varied from case to case. The nucleus was frequently eccentric, and the nucleolus ill defined and near the nuclear membrane. Perinuclear chromatolysis was common. The neurons of the *corpus striatum* were usually less involved. Slight to moderate changes were seen in the nuerons of the brain stem, especially in the motor nuclei, and of the anterior horns of the spinal cord. However, infiltration with cells was more obvious than cellular destruction. Focal accumulations of reactive cells were present in the red and olivary nuclei in some cases. There was no constancy of the pattern of involvement.

In contrast, the Purkinje cells of the cerebellum were reduced in number. Although some of the remaining cells showed changes in the nuclei and cytoplasm, the characteristic feature was disappearance of cells, relatively slight transitional change being seen. Long stretches of folia were denuded of cells (Figure I). An increase in the nuclei of Bergmann's glia was apparent. Involvement of the cerebellar cortex was slight in one patient (Case 24). No inclusion bodies were seen.

Reactive Changes.—The general tissue reaction was only moderately intense in the brain. There was a diffuse increase of cells in the grey matter of cortex, basal ganglia, brain-stem and spinal cord, with more obvious focal accumulations of lymphocytes and pleomorphic microglia. Occasional macrophages containing fat were present, and there was a slight increase in the number of astrocytic nuclei. Perivascular cuffing was present to a slight or moderate degree, sometimes extending from focal accumulations to the surface of the brain or into the white matter. The cellular infiltration was greatest in the anterior horns of the spinal cord (Figures IIIA and IIIB) and also involved the posterior horns to some extent. The interfascicular cells in the white matter appeared to be more numerous than usual, and sometimes small collections of lymphocytes and microglial cells were present (Figure II). The infiltration of the white matter of the cerebrum and of the central part of the cerebellum was so great in one case (Case 24) as to suggest direct attack upon the white matter.

There were foci of tissue damage and cellular infiltrations ranging in size from 200μ to 400μ in the deeper part of the molecular layer of the cerebellum. The interstitial tissue appeared to have lost its usual compact appearance, pleomorphic and phagocytic microglia with a few astrocytes and unidentified cells with dark nuclei lying in a loose stroma. Purkinje cells had disappeared in and near these foci. The foci sometimes reached to the surface, or cuffed vessels extended outwards to the pia-arachnoid. No disturbance of the granular layer could be identified; possibly the densely packed dark-staining nuclei of the granular layer obscured minor changes.

The pia-arachnoid was loosely infiltrated with lymphocytes and histiocytes, with occasional polymorphonuclear

cells. These cells also infiltrated the walls of pial vessels and formed dense adventitial cuffs.

Stage of Subsiding Inflammation.

A later stage of the lesion was seen in a patient who died on the thirty-fourth day (Case 9).

Diffuse and focal damage, with neuronal loss, microglial reaction, moderate cuffing of vessels and astrocytic proliferation were apparent in the grey matter. There was more gliosis than in the acute stages, the astrocytes being larger than normal and sometimes arranged in undivided pairs. Fat-laden macrophages were present in greater numbers than normal.

The Purkinje cells had suffered less damage in this case. However, foci of microglial and astrocytic proliferation were present in the deeper parts of the molecular layer, together with perivascular cuffing of vessels (Figure IV).

A feature of this stage, as opposed to the acute lesion, was the presence of a number of small round foci of degeneration in the basal ganglia and pons (Figure V). These areas stained very poorly, being crossed by an irregular reticulum in which few nuclei were to be seen.

Chronic or Severe Residual Stage.

An only partially bridged gap exists between the pathological lesion of the acute stages and that seen in two infants (Cases 1 and 4) who died at a later stage of the disease (on the sixtieth and ninety-third days).

A boy, three months old, became ill on January 1, 1951. On January 5 the child was noticed to be grizzly. He had a slight cough and would not take his food. On the following day he had a number of fits each lasting for a few minutes, in which the right side twitched more than the left. He responded irritably when his neck was moved. He remained unconscious and on his admission to Mooroopna Hospital on the third day his temperature was 103° F. The deep and abdominal reflexes were absent, the right plantar response was extensor, the left equivocal. The cerebro-spinal fluid contained 760 cells per millilitre, 90% having round nuclei. Head retraction and opisthotonus increased over the next few days. By the twelfth day he seemed somewhat better, and sucked a little. He was drowsy, and peevish when roused. There was persistent head retraction, attempts at moving his neck producing obvious distress. On the fifty-second day the child lay with head extended and turned to the right side. His back was arched. His eyes seemed observant. The pupils were of moderate size, the right reacting to light better than the left. The arms were in constant movement. The right hand described a roughly circular course, the forearm remaining variably pronated. The closed hand travelled from the patient's side to the region of the xiphisternum, and thence, the elbow extending, the hand passed across the abdomen, pressed into it, until the arm was by the side, the fingers here slightly extending. Thence the shoulder abducted and the elbow flexed to carry the hand once again to the region of the xiphisternum. The limb was moved in a stiff fashion, with fine tremor of the arm. The left hand described a rough oval, from the ear across the front of the chest, down to the side and thence up to the ear. The wrist was usually flexed and the metacarpo-phalangeal joints were sometimes extended. The muscles of the upper limbs opposed varying resistance to passive manipulation, the tone being greatest in the flexors. The lower limbs were maintained rigidly in extension, opposing strong resistance to attempts at passive flexion. The knees were slightly hyperextended and held close together. The feet and toes were plantar flexed. Occasionally the feet and toes extended, with fanning of the toes. The deep reflexes could not be elicited. The abdominal reflexes were absent. The feet dorsiflexed in response to plantar stimulation, the toes sometimes extending slightly.

This state of affairs remained until the child died of bulbar failure on the sixtieth day of illness.

The surface of the cerebral hemispheres was congested, and many focal points of subarachnoid hæmorrhage were present. The pia-arachnoid was somewhat thickened. Intrinsic changes were slight. There was no great reduction of cortical neurons, although judgement of numbers is difficult. Some vessels had small perivascular cuffs of cells. The most striking abnormality was an increase in glial nuclei. Astrocytes had increased, and phagocytic cells were still present. Fat-laden microglial cells were scattered through the white matter, and Marchi's stain showed some degeneration of myelin.

The thalamus on each side, however, showed marked abnormality. A roughly circular pinkish-yellow patch of degeneration replaced part of the pulvinar of the left thalamus, abutting upon and involving the inner part of the posterior limb of the internal capsule. A similar area in the region of the medial thalamic nucleus on the right side abutted upon the third ventricle. The central parts consisted of necrotic material, surrounded by a zone packed with macrophages and astrocytes. In both zones small deposits of calcium salts occurred. The whole cerebellum was shrunken, the foliæ being narrow and the intervening sulci widened (Figure VI). The pia-arachnoid was thickened and of brown colour. Vast numbers of Purkinje cells had disappeared (Figure VII). In many places the granular cells had also disappeared, Bergmann's glia had proliferated. The neurons of the dentate and other roof nuclei showed little change. Fat-laden macrophages were scattered throughout the cerebellum, in cortex and medulla, and in the pia-arachnoid. Both Marchi and Weigert-Pal methods showed degeneration of axons. Deposits of calcium were present in the cortex. The medulla showed patchy change, the neurons being patchily affected, with some infiltration of white matter. The pyramidal tracts in the spinal cord were stained very poorly by the Weigert-Pal method.

On January 10, 1951, a female of five months had diarrhœa. She then appeared well until on January 14 she vomited in the evening and lay awake all night. During the next morning her mother noticed that she seemed rigid, and she would stiffen when her napkins were put on. On January 16 her head was retracted, she was feverish, she vomited and dark green patches were noticed in the fæces. She did not rouse during the night and was thought to be sleeping. However, in the morning she seemed blind, and responded very little to any form of stimulus. During the night she became convulsed for some fifteen minutes, her face, arms and legs being equally involved. She was admitted to the Children's Hospital, Melbourne, on January 17, a week after the onset of encephalitic symptoms. On admission to hospital her temperature was 102·4° F., the pulse rate 156, and respiration rate 28 per minute. She responded very little to any form of stimulation, although her eyes remained widely open. The fontanelle was tense. The right arm and leg were moved less than the left, and passive manipulation of all limbs encountered variable rigidity of lead-pipe variety. The neck and back were stiff. The cerebro-spinal fluid contained 100 cells per cubic millimetre (70% lymphocytes, 30% polymorphonuclear cells) and 90 milligrammes *per centum* of protein. The chloride and sugar contents were within normal limits.

On the second evening the temperature reached 104·4° F. Subsequently it rarely rose above 101° F., usually fluctuating being 96° F. in the morning and 99·2° F. in the evening. Subsequently it rarely rose above 101° F., usually fluctuated between 99° and 100·8° F. The pulse rate ranged between 126 and 160 per minute, and the respiratory rate between 36 and 50 per minute. Nine days after onset significant improvement was noticed. The eyes were open, all limbs were moved in response to painful stimuli and were no longer stiff. The reflexes were normal. On the thirteenth day complete right facial paralysis was noticed and the right arm was flaccid and immobile. The cerebro-spinal fluid now contained 11 lymphocytes per cubic millimetre and the protein content was 40 milligrammes *per centum*. On the twentieth day the right hand was noticed to move voluntarily, and later in the day the child was cyanosed and right basal pneumonia was diagnosed. Movement of the right arm improved and horizontal fluttering movements of the eyes were noticed as the child's eyes rolled from side to side. On the twenty-third day the limbs were again stiff. Profuse sweating was noticed, especially on the left side of the head. On the thirtieth day the cerebro-spinal fluid contained five lymphocytes per cubic millimetre and 20 milligrammes *per centum* of protein. The child remained in a coma, her eyelids being open and her eyeballs frequently roaming from side to side. On the thirty-ninth day spasms of profuse sweating occurred. The right side of the face was completely paralysed. The arms were adducted at the shoulder joints, and the forearms were slightly flexed and pronated. The hands were tightly closed. From time to time tonic flexion of elbows and wrists occurred. The lower limbs were extended and the feet plantar-flexed. The tone varied considerably; sometimes it was great, sometimes less marked. The feet could usually be dorsiflexed with ease. The deep reflexes in the arms were brisk. The knee jerks varied from examination to examination. The abdominal reflexes were absent. The plantar responses were flexor. No changes of tone were detected in the limbs during full rotation of the head to either side. No voluntary movement occurred in the limbs, but the left side of the face screwed up normally when

the patient cried, as she did in response to any disturbance. The left eyelid closed and opened in time with respiration and crying.

The child remained in the vegetative state for some seven weeks, being fed by Rehfuss tube. On the ninety-second day of illness bilateral bronchopneumonia with consolidation was diagnosed. The temperature rose to 104° F. Respirations were rapid and shallow. The cerebro-spinal fluid gave evidence of pneumococcal meningitis. The child died on the next day.

The electroencephalogram showed disorganization of cerebral rhythm, with much slow activity (Figure VIII). On the sixtieth day low voltage activity predominated in all regions at the beginning of the record (two-per-second to three-per-second low voltage fluctuations, with fairly

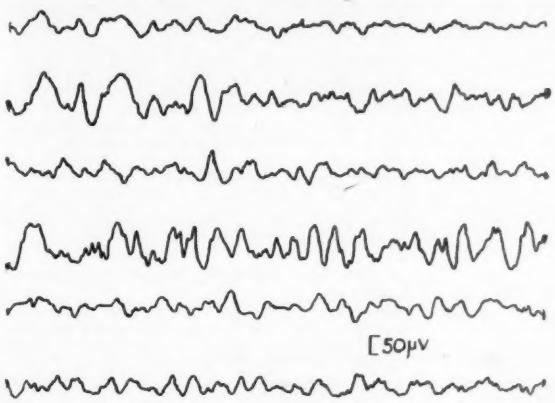

FIGURE VIII.

Electroencephalogram of Case 4. The records from above below are from pairs of electrodes arranged on each side of the median plane from frontal to occipital regions. The first three tracings are from the right side, the second three from the left. In this figure 1·3 millimetres is equivalent to one second.

regular small nineteen-per-second waves superimposed). From time to time runs of higher voltage (70 μV) three-per-second waves emerged, especially on the left side. Sometimes this discharge was confined to one lead, sometimes it involved all leads on the left side, the phase being sometimes reversed between parietal and occipital regions. However, on the whole, there was little synchronism of discharge. Later, higher voltage 1·5-per-second waves occurred at random or in series, for example, synchronously and of high voltage in the right parietal, right occipital and left occipital records. Subsequently only very short runs showed the initial low voltage activity. The frontal records showed less very slow activity than other regions, the dominant frequencies being about five per second. Some correspondence of rhythms was present. Sometimes the occipital records were very irregular and of much higher voltage than the other records. The temporal records were perhaps even more irregular with much greater independence of the rhythms from the two sides and different parts of the temporal lobes.

The cortical neurons were much sparser than in the previous case, and more microglial and astrocytic proliferation was present. Perivascular cuffs were thicker and more numerous. Infiltration of the pia-arachnoid with polymorphonuclear cells was more marked. This was due to pneumococcal meningitis which was a terminal infection and was not likely to have extended far beyond the meninges. The whole thalamus on each side was replaced by a reticulum containing irregular spaces (Figure IX). The contrast between destroyed thalamus and macroscopically normal *globus pallidus* was striking. Microscopically, neurons had disappeared. Astrocytes were few in number, the remaining cells being larger than usual, with large processes with few branches. Microglial cells infiltrated the necrotic material. The larger irregular spaces contained fat-laden microglial cells, lining the walls, which were formed by irregular fringes of necrotic tissue. Quite large rounded collections, composed entirely of macrophages, surrounded small blood vessels. The *corpus striatum* showed only a moderate degree of cellular infiltration.

The cerebellum showed similar microscopic alterations to those seen in Case 1, but the macroscopic changes were less marked. The cerebellum was not shrunken. The cut surface had an unusual greyish shiny appearance. Many yellow areas composed of degenerated foliæ were seen. From many regions neurons had entirely disappeared, throwing into prominence the increase in Bergmann's glia (Figure X). Macrophages were less numerous than in Case 1, perhaps because of the longer duration of the illness. The neurons of dentate and roof nuclei had disappeared. The brain stem showed patchy disease. The contrast between the slightly infiltrated facial nucleus on one side and the almost complete destruction of neurons on the other was a striking feature. The pyramidal tracts through the brain stem showed some degenerative changes, together with infiltration by phagocytic microglial cells.

Thus in these two cases death was not due to the inflammatory stage of the disease. However, the precise duration of the latter phase is unknown. In general, inflammatory changes had disappeared, leaving evidence of much more intense and more widespread involvement than was to be expected from the acute material. This might be due to inflammation continuing beyond that seen in the acute cases examined, but the possibility existed that certain regions were more profoundly damaged than in acute cases.

Discussion.

Correlation of Clinical and Pathological Features.

The diffuseness of the inflammatory change and the absence of detailed knowledge of the interaction of various anatomically defined regions severely hamper attempts at correlation of clinical and pathological findings. The involvement of motor cortical cells, extrapyramidal cells, and descending tracts would seem to offer a sufficient explanation of paralysis of upper motor neuron type. Involvement of motor cells in the lower part of the brain stem affords an obvious explanation of the complete unilateral paralysis of facial muscles seen in one patient, and of the bulbar failure which was the common cause of death. Disease of anterior horns of the spinal cord was marked and contributed its distinctive element to the muscular weakness.

The varying and usually severe degree of impairment of consciousness seems out of proportion to the microscopically evident lesion in the cerebral cortex. However, profound alteration in the electroencephalogram indicates the presence of gross alteration in cortical activity. Impairment of pacemaker activity of thalamic centres might be evoked as an explanation. Certainly the gross involvement of the thalamus would fit in with this explanation.

Inflammation of the *corpus striatum* may be advanced as an explanation of the various involuntary movements, but the explanation is, at best, a partial one. Varying degrees of involvement of all areas concerned with the stabilization of muscular movement must be evoked.

Finally, the disproportion between the profound cerebellar lesion and the observed ataxia deserves comment. The lesion of the Purkinje cells was observed early, yet subsequent examination of patients, although necessarily limited in severely affected cases, revealed little ataxia of cerebellar type. However, the state of the seriously ill patient precluded detailed examination. The complicated involuntary movement performed seemed to be well coordinated. Such total lesions of cerebellum and thalamus lack previous description.

Comparison with Pathological Findings in Other Encephalitides.

The pathological features of Murray Valley encephalitis were similar to those of Japanese B encephalitis, which have been described by Olitsky and Casals, and by Zimmerman. The last-mentioned author was the first to remark on deposits of calcium salts at the site of injury in chronic cases. Similar deposits were a feature of late cases of Murray Valley encephalitis.

There is also a close comparison between the pathology of Murray Valley encephalitis and of Australian X disease. Human brains infected with Australian X virus were examined by Cleland and Campbell in 1917 and 1918. These authors described little change in the cerebellum, a point of difference from the current findings with Murray Valley

encephalitis. However, in 1936, Perdrau restudied some of Cleland and Campbell's material and decided that the Purkinje cells were "undoubtedly affected, though not extensively". The presence of empty "baskets" was used as a criterion of absence of Purkinje cells.

The suggestion has been made on other grounds that Murray Valley encephalitis may be Australian X disease; from an examination of the pathological material there is no inconsistency in this suggestion.

Summary.

The characteristics of the lesions may be summarized:

1. *Primary Changes.*

(i) Involvement of neurons is the most obvious feature of the acute stage.

(ii) The later lesions show that more widespread necrosis may occur. Total tissue necrosis of areas of the white matter, of the thalamus and of the cerebellar cortex occurs. Secondary degeneration of nerve fibres contributed to the picture of destruction.

2. *Reactive Changes.*

(i) Microglial response appears earliest as a response to the viral attack, and persists longest, together with histiocytic activity, as a phagocytic phenomenon. The cells are seen in grey and white matter and in the meninges.

(ii) Lymphocytic infiltration occurs but is less striking than the description of other similar inflammatory diseases leads one to expect.

(iii) Astrocytic proliferation follows at a later stage. However, the increase commences quite early and becomes marked.

3. *Distribution of the Lesion.*

The changes in the early stage are both diffuse and focal, chiefly in the grey matter, although some features suggest involvement of white matter. The Purkinje cells of the cerebellum may disappear in the acute stage, with little obvious reaction. Neurons throughout the whole central nervous system are involved. The chronic stages emphasize the occurrence of total necrosis, exemplified by small areas of degeneration in basal ganglia and in the white matter of the pons, by large areas of disintegration in the thalamus, and by diffuse or focal degeneration of all component parts of the cerebellar cortex, except the Bergmann's glia, astrocytes and microcytes. Calcium salts may be deposited in these stricken areas.

Acknowledgements.

The bulk of the pathological material was very kindly sent by Dr. M. Benson and Dr. L. H. Lanyon from the Murray Valley. One specimen was provided by the Department of Clinical Research of the Royal Melbourne Hospital and one by Dr. J. Perry and Dr. A. Williams, of the pathological department of the Children's Hospital. The microscopic preparations were made by Miss Olive Leberg at the Royal Melbourne Hospital and by Miss Helen Wischusen, through the very helpful courtesy of Dr. K. O. Maynard, pathologist, and Dr. S. McLennan, medical superintendent of the Heidelberg Repatriation Hospital. I am very grateful for the stimulating discussion of the subject which I had with Dr. Ray Adams, of the Boston City Hospital.

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Legends to Illustrations.

FIGURE I.—Acute stage, cerebellar cortex: disappearance of Purkinje cells and diffuse infiltration of molecular layer, with increase in number of nuclei of Bergmann's glia. (Hæmatoxylin and eosin, × 130.) Case 27.

FIGURE II.—Acute stage: cellular infiltration and perivascular cuffing in internal capsule. (Hæmatoxylin and eosin, × 140.) Case 27.

FIGURE IIIA.—Acute stage, spinal cord: diffuse and focal infiltration of anterior horn of lumbar segment. (Hæmatoxylin and eosin, × 80.) Case 16.

FIGURE IIIB.—Intense perivascular and early neuronal change in the anterior horn of thoracic segment. (Hæmatoxylin and eosin, × 250.) Case 16.

FIGURE IV.—Transitional subsiding stage, cerebellar cortex: infiltration of molecular layer with glial cells, perivascular and pial infiltration and disappearance of Purkinje cells. (Hæmatoxylin and van Giesen, × 150.) Case 9.

FIGURE V.—Transitional stage, anterior part of pons: unstained area, crossed by a loose reticulum, due to degeneration with subsequent absorption. (Phosphotungstic acid hæmotoxylin, × 180.) Case 9.

FIGURES VIA AND VIB.—Chronic stage, cerebellum, showing shrunken foliæ and lack of differentiation between grey and white matter. Case 1.

FIGURE VII.—Chronic stage, cerebellum: degeneration of cortex and medulla, proliferated Bergmann's glia alone marking the original cortex. Macrophages are present throughout, and infiltrate the thickened pia-arachnoid. Dark patches of calcium deposits are seen in the cortex. (Hæmatoxylin and *Schariach R*, × 130.) Case I.

FIGURE IX.—Chronic stage: thalamic degeneration, macroscopically evident. Case 4.

FIGURE X.—Chronic stage, cerebellum: the process of absorption is almost complete. The vesicular nuclei of Bergmann's glia are greatly increased in numbers, and are the only remnants of the original cortex. Case 4.

MURRAY VALLEY ENCEPHALITIS: SURVEYS OF HUMAN AND ANIMAL SERA.[1]

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IN an earlier paper of this series French has described the preparation of a complement-fixing antigen from the virus of Murray Valley encephalitis (MVE). Essentially this involves the saline extraction of infected chorioallantoic membrane. Using this antigen, Mrs. Donnelley developed an overnight ice-box complement-fixation test applicable to human and equine sera. This test will be described in a later paper. It has been applied extensively in a study of the epidemiology of Murray Valley encephalitis.

Forty clinically diagnosed cases of Murray Valley encephalitis were studied in northern Victoria and closely adjoining parts of New South Wales in 1951. As mentioned above, these were diagnosed in the first instance on clinical grounds alone. The serological examinations carried out in these forty cases divided them into five

[1] This work was aided by a grant from the National Health and Medical Research Council, Canberra.

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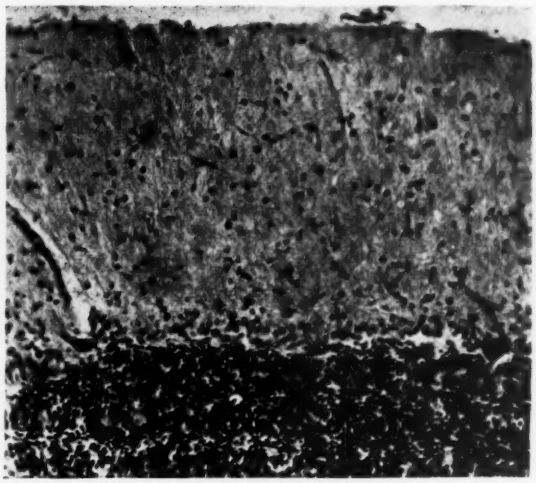


FIGURE I.

FIGURE II.

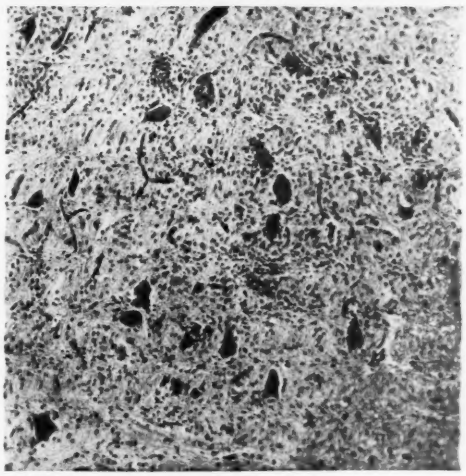


FIGURE IIIA.

FIGURE IIIB.

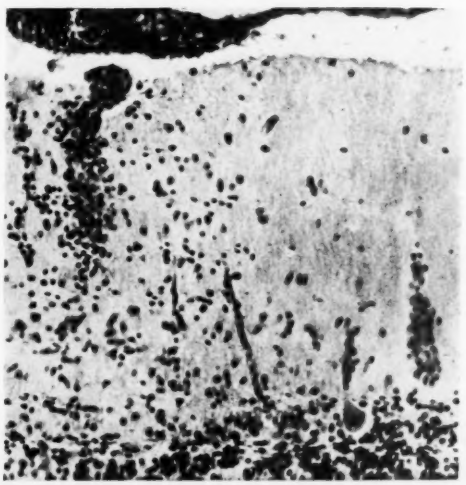


FIGURE IV.

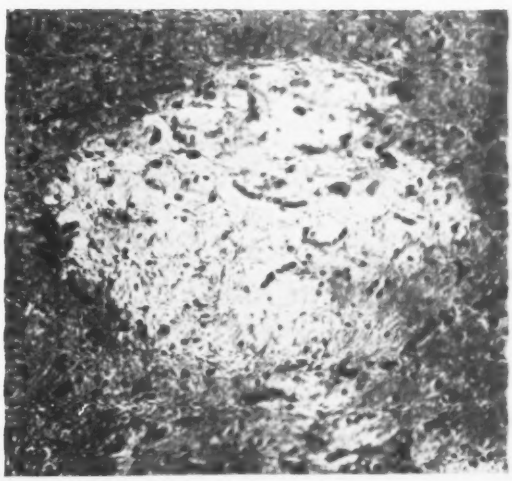
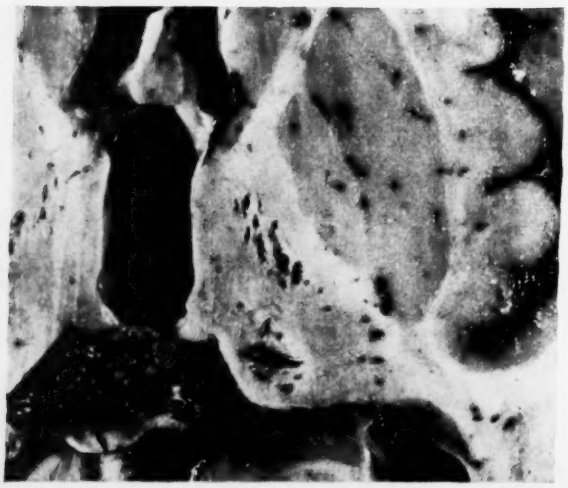


FIGURE V.

ILLUSTRATIONS TO THE ARTICLE BY E. GRAEME ROBERTSON.

FIGURE VIa.

FIGURE VIb.



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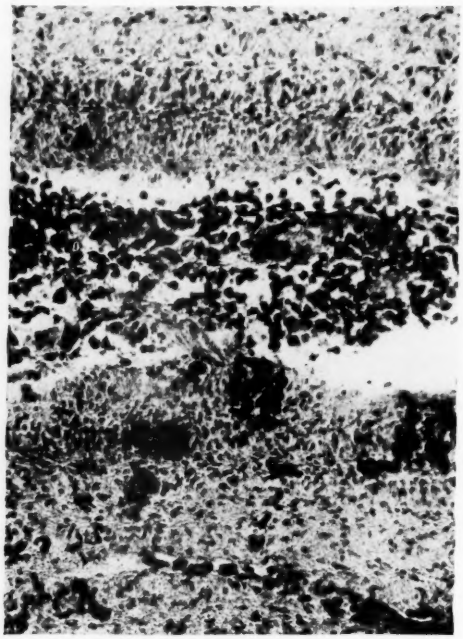

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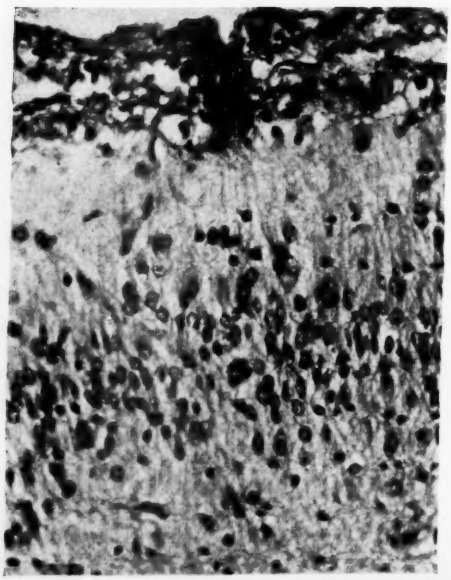

FIGURE X.

groups, a serum being designated positive if it carried a complement-fixing titre of 7·5 or more.

1. Seven patients died before serum was taken. In Case 16[1] the post-mortem appearance of the brain was consistent with the diagnosis of Murray Valley encephalitis. From Case 24 virus was isolated from the brain (French, 1952). In the other five cases (Cases 5, 7, 18, 28, 29) the final diagnosis rested only on clinical evidence.

2. Two patients died before a rise in antibody might have been expected. In Case 13 the patient was bled six days after onset and in Case 23 bleeding was carried out three days after onset. In neither instance was antibody present.

3. Case 17 was the only one of the forty in which examination was carried out more than fourteen days after onset and in which no circulating complement-fixing antibody was found. The negative sera were obtained at days 2, 24, and 61. The clinical course of this individual has been described by Robertson and McLorinan.

4. Four individuals (Cases 21, 26, 27, and 40) had a negative serum on first examination, within five days of onset, but developed circulating antibody before the twenty-second day of the disease.

TABLE I.

Course of Complement-Fixing Antibody Titres in Clinical Cases of Murray Valley Encephalitis.

Case Number.	Days after Onset.	Complement-Fixation Titres.
6	44	240
	72	240
	217	20
11	37	240
	89	60
	235	35
14	11	20
	15	30
	38	53
	244	25
19	17	6
	38	30
	71	8
22	12	26
	30	160
	256	640
25	19	53
	29	210
	49	270
	228	140
35	14	15
	35	120
	203	60
38	15	26
	200	30
40	4	<5
	18	40
	26	30
	89	40

5. Antibody was present in the first blood taken in 26 cases—in Cases 15, 32, 33 and 39 the first blood was taken between two and five days after the onset. In the remaining 22 cases the first blood was obtained after the tenth day of the disease (Cases 1, 2, 3, 4, 6, 8, 9, 10, 11, 12, 14, 19, 20, 22, 25, 30, 31, 34, 35, 36, 37, 38).

In summary, 31 patients were examined serologically when evidence of infection with Murray Valley encephalitis might have been expected. In only one case (17) was this evidence lacking. In four cases the rise in titre of antibody leaves no doubt that the illness was due to Murray Valley encephalitis. In 26 cases in which the only serological evidence of infection was a positive convalescent serum, there could be some uncertainty in any individual case, as to the cause of the encephalitis. We show later that less than 25% of normal people in the same community carried complement-fixing antibody to Murray Valley encephalitis. We may assume, therefore, that nearly all of the patients who were found to have circulating antibody during convalescence were indeed convalescing from Murray Valley encephalitis.

Because of these findings, and in view of the uniform clinical and, where studied, the pathological picture of the 40 encephalitis cases in northern Victoria in this outbreak, it is believed that the outbreak was of single ætiology.

Late convalescent sera have been examined from 12 of the forty patients. Typical results are recorded in Table I. In many cases a considerable titre remained at the end of seven months; in no case had circulating complement-fixing antibody completely disappeared. Although there is considerable variation between the rates of disappearance of antibody in different subjects, these figures would lead one to expect a detectable level of antibody in the convalescent serum twelve months after the initial infection—that is, during the next period of possible prevalence of the virus. In contrast to the persistence of antibody following severe clinical infection, there may be a rapid fall in titre following mild or subclinical infection. Six such persons who carried antibody earlier in the year were tested again in August and September (Table II).

TABLE II.

Course of Complement-Fixing Antibody Titres Following Mild or Subclinical Infection with Murray Valley Encephalitis Virus.

Case Designation.	Date of Bleeding.	Complement-Fixation Titre.
A	20.4.51	17
	15.9.51	<5
B	7.3.51	53
	16.8.51	<5
C	23.4.51	40
	15.9.51	<5
D	March, 1951	320
	15.9.51	<5
E	2.5.51	40
	17.9.51	7·5
F	22.4.51	53
	15.9.51	7·5

Healthy People.

In Shepparton and the Mildura-Wentworth Area.

Between February and September 30, 1951, 1378 healthy individuals in highly endemic regions in northern Victoria were examined for the presence of complement-fixing antibody to Murray Valley encephalitis virus. The donors were drawn from two areas in northern Victoria where cases of Murray Valley encephalitis were most prevalent—Shepparton in the north-east and the Mildura-Wentworth area in the north-west.

A preliminary survey of adult sera from these areas showed 8 of 99 from the Shepparton area to carry antibody and 35 of 144 from the north-west to do so. These figures were modified somewhat by a further survey, as shown in Table III.

Antibody to Murray Valley encephalitis occurs in one adult in 22 in the Shepparton area, and in one adult in five in the Mildura-Wentworth area. Even within the Mildura-Wentworth area there is a considerable variation in the incidence of antibody. At Wentworth the proportion of positive adults rises to over one in three.

The incidence in children in the Mildura-Wentworth area runs well below that in adults, with a ratio of about one child to three adults. Since the number of children under fifteen years severely affected in the recent epidemic was slightly higher than the number of older patients, it is suggested that children are more likely to be severely affected than are older persons, following an infection with the virus.

[1] The case numbers quoted here correspond with those recorded in the first paper of this series.

To our knowledge, none of the above donors was related in any way to a patient suffering from Murray Valley encephalitis; but in both Shepparton and Mildura a small series of "contacts" was examined. Essentially these persons were exposed to the same home environment as "cases". Of 43 "contacts" at Mildura, eleven gave positive sera. Of 23 at Shepparton, five were positive, in addition to an interesting group in relation to Case 33.

TABLE III.

Geographical Distribution of Complement-Fixing Antibody to Murray Valley Encephalitis Virus, Victoria, 1951.

Area.	Donors.	Number of Sera Tested.	Number Sera Positive.	Percentage of Sera Positive.	
				Adults.	Children.
Mildura[3]	Adults.[1]	128	13	10	—
	Children.[2]	78	4	—	5
Red Cliffs[3] ..	Adults.	18	3	17	—
	Children.	73	3	—	4
Merbein[3]	Adults.	87	15	17	—
	Children	56	4	—	7
Wentworth[3] ..	Adults.	97	35	36	—
	Children.	36	6	—	17
Total Mildura-Wentworth area	Adults.	330	66	20[4]	—
	Children.	243	17	—	7[5]
Shepparton ..	Adults.	398	18	4·5	—
	Children.	407	19	—	4·7

[1] Fifteen years of age and over.
[2] Over four and under fifteen years of age.
[3] These towns comprise the Mildura-Wentworth area.
[4] Males, 2·3%; females, 16·5%.
[5] Males, 7·5%; females, 6%.

In Case 33 the patient was a worker in a construction camp at Shepparton. Eighty-one of his co-workers, many of whom were recent arrivals in the district, were examined serologically, though none gave a history of illness. Of these men, 55 lived in the town of Shepparton, some distance from their work. Only one of these gave a positive serum. The other 26 men slept in a hostel erected at the site of their work, as also did the patient in Case 33. Six of these 26 men provided positive sera. Arising from this observation, it was suggested by one of us (W.S.) that night-biting mosquitoes might well be first suspects as the vectors of the virus.

In the Rest of Victoria.

In the same period from February to September 30, 1951, an effort was made to obtain sera from the larger towns throughout Victoria. In this work we relied entirely on the kindness of the Red Cross Blood Transfusion Service and the Public Health Laboratory in Melbourne. It so happened that no serum from these sources was examined from either the Mildura area or the Shepparton district. The results are as shown in Table IV.

TABLE IV.

Murray Valley Encephalitis Complement-Fixing Antibody in Victoria (excluding Shepparton and Mildura Areas).

Area Examined.	Number of Sera Examined.	Number of Sera Positive.	Percentage of Sera Positive.
North of Divide	796	25	3·1
South of Divide, excluding Melbourne	938	8	0·8
Melbourne	1021	7	0·7

While the 2755 sera were drawn from centres scattered throughout the whole of Victoria, not every town, nor even every sizeable area was represented. Nevertheless the areas of high endemicity of the Murray Valley encephalitis virus would appear to be Mildura and Shepparton, with a rather more sparse incidence of the infection throughout the rest of northern Victoria. The movement of people across Victoria must weaken the conclusions drawn from a mass serological survey such as that represented in Table IV. We believe that this factor may account for the 15 positive sera (0·8%) discovered south of the Great Dividing Range. The titres obtained in these sera were low, eleven being 1:10 or less, three 1:15 and one 1:30. Efforts to obtain individual histories from these fifteen subjects have met with success in only three cases. These three persons had visited northern Victoria recently. In one case the last visit to the Murray was made during the summer of 1949.

Mild Cases.

The clinical histories of three "mild cases" have been presented above by Robertson and McLorinan. Many cases of this type were encountered throughout northern Victoria during the period of the encephalitis outbreak. The mild nature of the illness prohibited lumbar puncture, but convalescent sera were examined from 31 such patients in north-eastern Victoria and three were positive. Similarly, from north-western Victoria nine of 19 were positive. These proportions are somewhat higher than the incidence of antibody in healthy individuals from the same regions.

We believe that a few of these mild cases may have been due to Murray Valley encephalitis but that the majority were due to other causes. This belief is supported by examination of the titres of antibody in the serologically positive "mild cases" (Table V). The range of titres of antibody in severe cases is at a higher level than the positive titres in healthy individuals. The titres of positive sera among "mild cases" are comparable in magnitude with those of healthy individuals.

TABLE V.

Positive Murray Valley Encephalitis Complement-Fixing Titres in Various Clinical Types in Northern Victoria, February and March, 1951.

Titre.	Severe Cases of Encephalitis.	Mild Cases of (?) Encephalitis.	Healthy Individuals.
5	0	0	1
6– 10	1	3	5
–20	3	3	8
–40	6	5	7
–80	3	1	3
–160	6	0	1
–320	7	0	1
–640	1	0	0
Total ..	27	12	26

Unfortunately no opportunity was offered to examine acute and convalescent bloods from "mild cases".

Animal Sera.

Animal sera were obtained by Mr. W. Gee, of the Victorian Department of Agriculture. They were tested in the Hall Institute for complement-fixing antibody to Murray Valley encephalitis. Sixty-two sheep, 21 cattle and 24 pigs from northern Victoria showed no evidence of previous infection with the virus of Murray Valley encephalitis. Six of sixteen horses and five of ten dogs in northern Victoria were found with positive sera.

This survey of equine sera was extended through the courtesy of Dr. H. E. Albiston, Director of the Veterinary Research Institute, Parkville, and Mr. R. J. Talbot, of the Victorian Department of Agriculture. A total of 257 Victorian horse sera have been examined. Of 191 taken south of the Dividing Range, four contained Murray Valley encephalitis antibody in low titre. They came from Inverloch, Bemm and Jeeralong in the east and from Colac in the west of southern Victoria. Of 62 sera taken in northern Victoria, 31 were positive, with titres from 7·5 to 53.

The proportion of horses carrying Murray Valley encephalitis antibody is higher than the corresponding human figure in northern Victoria, but there is the same virtual localization of infected horses to northern Victoria. Inquiries directed to the owners of the four positive horses south of the Divide elicited the information that the horse at Inverloch had lived there all its life.

There is no evidence to indicate whether natural infection with Murray Valley encephalitis is ever symptomatic in a horse.

Five out of nine foxes and two of three opossums in the Wentworth area of New South Wales—just west of Mildura—also carried Murray Valley encephalitis antibody.

Avian Sera.

In recent years American studies on western equine and St. Louis encephalitides have pointed to the likelihood that wild birds may provide an important natural reservoir of the viruses and that domestic fowl may be implicated in their transmission by both mosquitoes and mites. The association of the Australian disease with the Murray River quite early suggested the possibility that the reservoir of the disease might be found in some of the large colonies of water birds that breed in the region. This hypothesis was further strengthened when Hammond, Reeves and Sathers's recent paper was received. In this they showed that a high incidence of antibody against Japanese B virus was found in large water birds taken in the vicinity of Tokyo. Work which is still continuing was therefore undertaken to assess the extent of Murray Valley encephalitis infection in birds present in the epidemic areas of northern Victoria.

Avian sera were obtained from the Mildura-Wentworth area in July, August and September, 1951, and examined for antibody in a mouse neutralization test. Although this phase of the work is not yet complete, it is already evident that avian infection with Murray Valley encephalitis is common in the area described. Fifteen of twenty species of waterbird and seven of twenty species of landbird have been demonstrated to carry antibody (neutralizing index 40 or more). The white-faced heron (*Notophoyx novæhollandiæ*), the Nankeen night heron (*Nycticorax caledonicus*), the little pied cormorant (*Phalacrocorax melanoleucus*) and the big black cormorant (*Phalacrocorax carbo*) are prominent in the list of donors of positive avian sera.

It is of considerable interest, and probably of epidemiological significance, that a high proportion of the domestic fowls which have been examined in Mildura carry Murray Valley encephalitis antibody, and that this antibody has been found predominantly in rural rather than urban areas of the Mildura district.

A full report of the study of avian sera will be published at a later date.

Serological Surveys Outside Victoria.

The sera to be described were collected between March and September 30, 1951.

Human Sera.

The human sera examined from areas outside Victoria may be considered in two classes. Firstly, sera were sent to us from cases clinically diagnosed as mild or severe encephalitis. Nine of these from New Zealand were negative. Fourteen such sera were received from Queensland, of which two contained Murray Valley encephalitis antibody in high titre. One of these was from Cairns and one from Charleville. These will be discussed in a later paper. Twenty-three sera from New South Wales furnished three high-titre positives, from Forbes, Griffith and Hillston respectively. A fourth, a patient from Narrabri, who died of Murray Valley encephalitis, is discussed in a later paper by Garven and French. His serum, taken early in the disease, contained no Murray Valley antibody, but a virus was isolated from his brain.

Secondly, sera were sent to us from people regarding whom there was no suspicion of encephalitis. These normal sera were mostly received from Commonwealth Health Laboratories. Results are presented in Table VI. It is felt that the presence of one very low titre serum both in Western Australia and in Tasmania cannot be accepted as evidence that the virus of Murray Valley encephalitis is endemic in those regions. Information concerning the movements of these two people is unobtainable. Albury, New South Wales, is on the Murray River in the region of Shepparton: it shows the same proportion of positive sera as does the latter city. From mid-February to early March, 1951, there were a few severe cases of "encephalitis" on Mornington Island in the Gulf of Carpentaria, adjacent to the coast of Queensland. Sera sent to us contained complement-fixing antibody to Murray Valley encephalitis virus.

TABLE VI.

Murray Valley Encephalitis Complement-Fixing Antibody in Human Sera Collected Outside Victoria, 1951.

Region from which Serum Despatched.	Number of Sera Examined.	Number of Sera Positive.
New Guinea	58	13
Queensland :		
Cairns	62	14
Townsville	26	4
Rockhampton	31	6
New South Wales :		
Wollongong	27	0
Canberra	14	0
Albury	94	5
Tasmania	85	1
Western Australia (Kalgoorlie)	55	1

Dr. M. J. Mackerras, of the Queensland Institute of Medical Research, then visited the island. She obtained a history of a widespread mild epidemic of neurological symptomatology among the natives on the island. The outbreak will be discussed in a later paper.

Sera obtained from a large number of natives and from three white residents on Mornington Island showed a high proportion of carriers of Murray Valley encephalitis antibody. Horse sera also showed a high incidence of antibody. It is believed that Murray Valley encephalitis virus is endemic on Mornington Island, but it is quite uncertain whether the outbreak that prompted the local survey was due to Murray Valley encephalitis.

It is believed that the serological results from New Guinea and Queensland can be accepted as indicating that Murray Valley encephalitis is endemic in those areas, although the possibility of cross reactions with a related antibody has not yet been eliminated. The New Guinea sera were all obtained from natives. The question of Murray Valley encephalitis in Queensland will be further considered in a later paper.

Equine Sera.

The sera to be described were obtained from animals not suspected of suffering from encephalitis. We are indebted to the veterinary officers in the States mentioned for the collection of specimens. The results are presented in Table VII. Titres of positive sera ranged from 5 to 20 and are accepted as probably due to prior infection with Murray Valley encephalitis virus. The two positive Queensland sera were sent from Rockhampton; those in New South Wales came from Narrabri on the Namoi River (four positive out of seven), Holbrook (three of twenty-five), Trangie (two of four), Grafton (one of ten), and Glenfield (one of ten). Detailed histories of the previous movements of these horses have not been obtained.

As is the case in Victoria, the general distribution of equine antibody to Murray Valley encephalitis in other Australian States resembles the distribution of human antibody to the same virus.

Discussion.

Murray Valley encephalitis virus is widely distributed throughout eastern Australia. Serological examinations reported in this paper reflect a high incidence of very mild, or probably subclinical, infections in humans from Cairns on the north-east coast of Queensland, down through Townsville to Rockhampton. The coastal area of New South Wales is perhaps clear of infection, but the virus appeared along the course of the Lachlan and on the upper reaches of the Darling River. More detailed information is available about Victoria, where there were severe cases of Murray Valley encephalitis along the course of the Murray Valley. The watershed which stretches across Victoria—the Great Dividing Range—forms a southern boundary to the Murray Valley and equally definitely limits the present endemic area of Murray Valley encephalitis.

TABLE VII.

Murray Valley Encephalitis Complement-Fixing Antibody in Equine Sera Collected Outside Victoria, 1951.

Region where Serum Collected.	Number of Sera Tested.	Number of Sera Positive.
Queensland	7	2
New South Wales	110	11
Tasmania	3	0
Western Australia	42	0

No clinical case of the disease is known to have been infected south of the Great Divide.

In northern Victoria the incidence of Murray Valley encephalitis infection varies considerably from place to place. The two regions known to be most heavily seeded are the Mildura-Wentworth area in the north-west with a 20% antibody rate in adults, and the Shepparton district in the north-east with an antibody rate of 4·6%.

The Mildura-Wentworth area has a population of 30,000, of which it is estimated that 6000 carry antibody to Murray Valley encephalitis virus. If we accept the viewpoint that these were all infected in the early months of 1951, when there were nine severe cases in the district, we would believe that there was one severe case for every 700 infections with Murray Valley encephalitis virus.

There has been considerable discussion regarding the occurrence of mild cases of encephalitis due to infection with Murray Valley encephalitis virus. Unfortunately we were not able to examine paired acute and convalescent sera from such cases. The only serological evidence available would suggest that some of the "mild cases of encephalitis" seen in northern Victoria last summer may have been due to Murray Valley encephalitis virus, but that the majority were not.

Infection of horses with Murray Valley encephalitis virus is common, and the distribution of antibodies in horses corresponds with the distribution of positive human sera discussed above. This does not necessarily imply that either horses or dogs are important sources of infection for man.

The finding of Murray Valley encephalitis antibody in a variety of wild and domestic birds further illustrates the resemblance of Murray Valley encephalitis to Japanese B and the other members of this group of viruses, and suggests that the epidemiology of Murray Valley encephalitis may resemble the story of Japanese B and the American insect-borne viral encephalitides (Hammond, Reeves and Sathers, 1951).

The following situation is at present unproven, but is the most reasonable hypothesis which can be based on the known facts. Murray Valley encephalitis is primarily an endemic disease of native birds. Spread from bird to bird is mediated by bird mites or mosquitoes. One or both types of insect carries the virus over from one nesting season to the next. New infections are most common in young nestlings, but occur also in adult birds. The infection leads to a viræmia, between the second and fifth day, with the probability that any mosquito which bites the bird during this period will be infected with the virus. Under favourable circumstances the mosquito will transfer the virus to other birds, native or domestic, or to man or susceptible animals.

It is not yet known whether horses and dogs develop a viræmia following infection with Murray Valley encephalitis virus, nor is there any certainty about how long such a viræmia would persist if it occurred. Because of the relative scarcity of horses and dogs in northern Victoria, however, it seems unlikely that they would be an important reservoir from which mosquitoes could be infected.

It is known, on the other hand, that domestic fowls exhibit circulating virus for about three days following infection with Murray Valley encephalitis virus. This, together with the finding of a large proportion of positive sera in Mildura fowls, indicates one likely important reservoir from which vectors could infect man. It may well be that one type of vector frequently carries Murray Valley encephalitis from wild birds to domestic fowls; and that another type is normally concerned in the transfer of virus from domestic fowl to man.

This picture of the hypothetical cycle of infection in Murray Valley encephalitis is simpler than the final story is likely to be. It is presented at this stage as the working hypothesis on which further studies are being planned for the 1951-1952 summer.

Summary.

The forty cases of encephalitis which occurred in the Murray Valley in 1951 were probably due to a single type of virus.

Complement-fixing antibody to Murray Valley encephalitis (MVE) virus has been found in humans and horses along the eastern portion of Australia from Cairns to the Victorian Great Dividing Range.

The area of maximum incidence of human antibody to Murray Valley encephalitis occurs in the Mildura-Wentworth area in the north-west of Victoria and the south-west of New South Wales.

No patient with Murray Valley encephalitis was known to have been infected in southern Victoria.

Murray Valley encephalitis antibody is present in native and domestic birds in the Murray Valley. It is likely that birds are the primary reservoir of infection from which mosquitoes transfer the virus to man and animals.

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Robertson, E. Graeme, and McLorinan, H. (1952), "Murray Valley Encephalitis: Clinical Aspects", THE MEDICAL JOURNAL OF AUSTRALIA, Volume I, page 103.

Books Received.

[The mention of a book in this column does not imply that no review will appear in a subsequent issue.]

"An Atlas of Normal Radiographic Anatomy", by Isadore Meschan, M.A., M.D., with the assistance of R. M. F. Farrer-Meschan, M.B., B.S.; 1951. Philadelphia: W. B. Saunders Company. Melbourne: W. Ramsay (Surgical) Proprietary, Limited. 10½" × 7", pp. 602, with 1044 illustrations. Price: £7 2s. 6d.

Intended to meet the needs of teachers in morbid anatomy, radiology and clinical medicine, and also those of general practitioners.

"CIBA Foundation Conference on Isotopes in Biochemistry"; editor for the Ciba Foundation, G. E. W. Wolstenholme, O.B.E., M.A., M.B., B.Ch.; 1951. London: J. and A. Churchill, Limited. 8½" × 5½", pp. 304, with 79 illustrations. Price: 27s. 6d.

Consists of papers presented at an informal meeting; these are arranged in six parts, each of which has its own editor.

The Medical Journal of Australia

SATURDAY, JANUARY 26, 1952.

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SPECIALTIES AND THEIR SCOPE.

PROBABLY few articles on specialization have been written without reference to the old definition of a specialist as one who knows more and more about less and less. Speaking of special branches of surgery, Donald Munro has said in an address that if the old definition is true, it follows that a general surgeon must be one who knows less and less about more and more. He thinks that no general surgeon will take this definition lying down. Surgeons, we all know, sometimes adopt queer attitudes and make unusual suggestions—there comes to mind a surgeon who in defiance of the rules of syntax wrote of a certain operating table that it gave great comfort to a surgeon when operating in the lithotomy position. Be that as it may, we shall probably all agree with Donald Munro's contention about the general surgeon's refusal to accept a belittling statement. He was addressing the annual meeting of the Massachusetts Medical Society in May, 1951,[1] and the title of his oration was: "How Specialized is a Specialty?" This is a question of practical importance in medicine and the reply will vary with different periods of medical history. At the risk of being wearisome, we must refer again to the assertion some years ago of the late Lord Moynihan that the zenith of surgery had been reached and that no further advances were likely to occur, and also to his curt refusal to tolerate any views to the contrary. The brain surgery of today and the surgery of the chest on heart and lungs alone show how wrong he was, and show also that any statement on the scope of a surgical specialty in Moynihan's day would be wrong if applied to the present time. That the scope of any specialty in surgery, in internal medicine or in any of the other branches of medical science shall be understood is necessary—it is more necessary today than it was in a previous generation and it will be still more necessary as further advances are made in the future. The need for understanding arises from the fact that men study and practise these specialties, that persons suffering from a diversity of illness seek treatment from specialists and that their relief will be the greater as the specialist's knowledge is wider and his wisdom more profound.

In a discussion on specialism and its safeguards in these columns on January 31, 1948, certain points were made which may with advantage be recalled when we discuss specialties and their scope. J. A. Bigger was quoted as having referred to the commonly held view that specialists are prone to suffer from progressive narrowing of the field of vision (our old definition about "more and more" and "less and less"). He declared that such a happening in medicine would be fatal. At the same time he mentioned Jefferson's denial that specialization is necessarily limiting to the mind and general scientific culture of the individual. We also referred to an address by E. D. Churchill in which he described four components of surgery—technology, humanism, science and empiricism. He also declared that the content of surgery differed from the content of medicine only in the greater range of surgical technology. Thirdly, reference was made to an address by Professor Harry Platt and to his contention that more than lip service ought to be paid to the idea that a liberal education is the essential prologue to the study of medicine and that the portals of entry should be kept wide open—the intellectual tradition is there to be nurtured. When the points of view represented by the statements of these authors are borne in mind, they will be seen as a solid foundation on which any argument on specialties and specialists can be based. As Munro is a teacher and a specialist in neurosurgery, he makes his points by reference to that subject. He points out that the care of patients with neurosurgical injuries calls for a high degree of general surgical knowledge. Not only is it necessary to display the judgement that is called for in the treatment of any surgical emergency, but there is required in addition a knowledge of orthopædics, of the proper care of the genito-urinary tract, of dietetics, of plastic surgery and of modern physiotherapy. What Munro writes about neurosurgery can be paralleled in regard to any other specialty. The general surgeon, for example, must know more than the purely surgical aspect of his subject. The technology, the humanism, the science and the empiricism mentioned by E. D. Churchill will include much of the science of internal medicine, to say nothing of the allied sciences. Such conditions as those associated with the thyreoid come to mind at once, for surgical operation has largely been superseded by other forms of therapy for some disorders of this gland. But the finger can also be pointed at endocrinology, nutrition and deficiencies in the diet, biochemistry, pharmacology and indeed almost any sciences we like to name as being essentially as it were at the surgeon's elbow for coupling-up, like stops and combinations of stops adding fullness and distinction to the work of a concert organist when used with skill and judgement. Again, we may think of the close association between pulmonary conditions and those of the nose and throat and of gynæcology in relation to urology on the one hand and endocrinology on the other. The ophthalmologist, often looked on as rather an individualist, would often (to use a colloquial expression) miss the bus if he did not look to general medicine and the basic sciences for a guiding hand in diagnosis or treat-

[1] *The New England Journal of Medicine*, May 31, 1951.

ment or both. And over all these subjects, taken singly or in combination, there is an enveloping blanket of psychiatry. The blanket will sometimes be fine in texture and almost negligible, but again it may be so thick that it must be removed before anything in the way of resolution of difficulties or correction of abnormalities is attempted. From these considerations we may agree that Munro is correct when he states that the measure of proficiency of any specialist (and we refer to the man supposedly well trained in his subject) is his basic knowledge of generalities.

Munro asks the question: "How specialized is a specialty?" He states that he does not know, but he strongly suspects that all surgical specialties are actually more general than they are usually suspected to be. He thinks that the specialist pendulum has swung too far and he would have some effort made to get it back, but "not to the standards of forty years ago". It is easy for a man of not very mature years who has become skilled in one of the smaller specialties to give an impression that he wears mental blinkers and is obsessed with the importance of the work on which he concentrates. Particularly is this true when great technical dexterity is required of him. Onlookers should not be too ready to attribute restricted vision to the specialist. It is wiser to consider what training he has had, first of all in general medicine and then in his special sphere. By and large we may say that an apprenticeship spent in general practice will tend to give a specialist an understanding of a man as a whole. A university training in general medicine and surgery is indispensable and credence should not be given to one who has had no such adequate training. Again, when a specialist has been trained for his specialty in a centre known to be a sound training ground, we may take it that he has at least had the general implications of his special subject kept before him. Thus we may conclude that the scope of a specialty, in other words how specialized it is, can be determined in little more than a general kind of way. The scope of a specialty is actually the scope of the man who practises it, and this is the way in which it should be understood and judged.

Current Comment.

HORMONAL TREATMENT OF LEUCHÆMIA AND LEUCOSARCOMA.

THERE is at present a more intense interest in diseases of the blood than we have seen before, perhaps excepting that aroused during that exciting era when biological staining techniques opened a new field in medicine. It is natural that this interest has been enhanced on the therapeutic side by the extraordinary alterative powers of the adrenal hormones and their stimulators. Numbers of trials of ACTH and cortisone have been made in the various types of leuchæmia and diseases of the Hodgkin group, but the reports in the acute forms are not encouraging, though partial remissions in the chronic forms have been observed. Grants from various sources made it possible to investigate the results of these substances in such cases by a research team over a period of eighteen months. In April, 1950, a preliminary report was made by this team, which comprised Martin C. Rosenthal, Richard H. Saunders, Lawrence I. Schwartz, Leda Zannos, Enrique P. Santiago and William Dameshek.[1] This report dealt with the results of using ACTH in eight cases of acute and subacute leuchæmia, and, since satisfactory remissions were obtained in five, further observations were made, as it was clearly recognized that these remissions were only temporary, and a further series of 34 patients was studied. Thus in all 42 patients were treated, mainly with ACTH, and in some instances with cortisone. Other forms of treatment likely to benefit the patients, such as blood transfusion for hæmatological reasons, or antibiotics when infection threatened with leucopenia, were given only for a clear indication, but were never withheld. Of the 42 patients, 27 had some form of leuchæmia, five had multiple myeloma, five Hodgkin's disease and five lymphosarcoma. The dosage of ACTH varied with the indication and also with the preparation used: 15 to 20 milligrammes were administered every six to eight hours to adults, with smaller doses for children. Cortisone was given in doses of 100 to 150 milligrammes daily by intramuscular injection or by mouth. Preliminary biochemical tests of the body fluids were made, and repeated if indications appeared. Diets with a low sodium content were adopted as soon as ACTH treatment was begun. Remissions were produced consistently in children with acute or subacute lymphocytic leuchæmia, but in one adult only. Maintenance therapy produced little effect, but remissions could be repeatedly obtained by repetition of treatment when relapse occurred. Eventually, however, a refractory state appeared, and the duration of all the remissions was disappointingly brief. The familiar side effects appeared, and were striking in the children, four of whom are shown in one photograph, looking pathetically alike. Acute granulocytic leuchæmia was practically unaffected by the hormones: only one patient had an encouraging remission, but she relapsed and died six weeks later. More promising results were obtained in the treatment of patients with the chronic forms of leuchæmia; although the numbers were small, four out of five patients showed striking subjective and objective improvement. In particular such manifestations as masses of lymphatic tissue or dermatoses were rapidly relieved, and this was the more welcome as these symptoms were resistant to or aggravated by X-ray therapy. Benefit was also observed from maintenance dosage of the hormones. The same applied to the treatment of the late stages of Hodgkin's disease; again, numbers are small, and the results are variable, but definite improvement may be produced, and occasionally the remission may be so satisfactory that a degree of activity with associated well-being may be restored to the patient. One striking finding is the relief of hæmolytic anæmia when this appears as a complication of diseases of these groups. Multiple myeloma which has not responded to treatment by urethane has also shown improvement after the administration of ACTH.

A similar investigation has been made by another team. M. M. Wintrobe, G. E. Cartwright, J. G. Palmer, W. J. Kuhns and L. T. Samuels have evaluated ACTH and cortisone in the treatment of a series of 40 cases of blood disorders in man.[2] The range of morbid states observed was wide, so that the individual numbers are restricted, but the inquiry parallels that already described. These authors found that five out of twelve patients with acute leuchæmia showed satisfactory remissions, though these were transitory, and had the features described by other writers. However, they did not observe any substantial difference between the granulocytic and the lymphocytic types; here they do not quite agree with others, but it is doubtful if statistical significance can be attributed to the reports in the literature as yet. It is curious that they did not observe any clinical change in several patients with chronic leuchæmia, though they report improvement in the blood state of patients with this and other blood diseases.

When we turn to the explanation of these findings we meet difficulties. It is evident that many workers are

[1] *Blood*, September, 1951.
[2] *Archives of Internal Medicine*, September, 1951.

trying to cover a wide field, from which they can only draw suggestive conclusions. Wintrobe and his associates discuss the mode of action of these hormones on the blood, and remark that the known power to lyse lymphocytic cells or tissue, the increased blood production, and alterations of immune reactions may be related to the observed phenomena. Rosenthal and his co-workers are a little more specific, and point out that the unexplained cycle of perverted physiology which initiates such clinical states as those we are discussing may possibly be interrupted at different points, thus making intelligible the improvements wrought by such diverse substances as aminopterin and ACTH. They remind us that folic acid antagonists affect enzyme systems in the proliferating cells, while the stimulation of marrow cells by the adrenal hormones may act reciprocally on the lymphocytic tissue cells. Whatever the reason, the regression of widespread neoplastic tissue is a remarkable phenomenon. At least the indications for ACTH or cortisone in these diseases are becoming clearer, and the correct usage of such precious material is of the highest importance.

ACUTE NON-SPECIFIC PERICARDITIS.

FROM time to time the subject of acute pericarditis reappears in medical literature, the term being used in the sense of an acute inflammation of the pericardial sac not necessarily terminal in nature, and not demonstrably due to a distinct and recognized infection. E. W. Gilley, M. C. McCord and J. T. Taguchi have collected a small but interesting series of nine cases, in which the most important clinical problem was the distinction between pericarditis *per se* and myocardial infarction.[1] This distinction is all the more important because both these conditions may have a favourable outcome, and because certain points in treatment make an accurate diagnosis significant. The patients were seen in a veterans' hospital and ranged in age from twenty-four to fifty-nine years, the average age being thirty-eight years. Their oldest patient gave some reason for doubt in the diagnosis, for in addition to a loud pericardial friction sound early and persistently present, there was also evidence of involvement of the left pleura, and the electrocardiogram suggested the possibility of a posterior coronary artery occlusion. However, the rapid disappearance of pericardial signs, and a more gradual clearing of abnormalities in the electrocardiogram, together with a return of the size of the heart to normal, as judged by radiological examination, were the prelude to complete recovery. Certain electrocardiographic details were more in conformity with a diagnosis of pericarditis than of coronary occlusion. The critic will, of course, remark that pericardial rubs have before now been proved to be in reality pleural in origin. Another case history of a patient who died proves by post-mortem evidence the existence of pericarditis, but without any sign of gross coronary or myocardial disease. In this man, who was aged fifty-two years, the only substantial change in the electrocardiogram was elevation of the *S-T* segment, with minimal notching of the *T* waves.

This case was of importance from the therapeutic point of view, for anticoagulant treatment was maintained, chiefly because of dissenting opinions, and autopsy revealed a blood-stained effusion in the pericardial sac. It is arguable that the anticoagulants may have done definite harm, since some degree of cardiac tamponade was demonstrated after death, which followed exertion by the patient while left for a brief period. Other cases showed a more clear-cut picture of pericarditis, without evidence of myocardial or other relevant disease; blood cultures yielded no information. The authors have drawn up a table of differential diagnosis in which certain features are stressed, such as the more intense and constant friction rub of non-specific pericarditis, rapid change in the size of the heart shadow, rare in myocardial infarction, and the more prompt appearance of leucocytosis, fever and rise in the sedimentation rate. Relation of the illness to respiratory disease is also more common in pericarditis, and the pain is usually intensified by respiratory movement. Circulatory collapse is a more frequent and striking accompaniment of myocardial accidents. The diagnostic help given by the electrocardiogram is not always quite reliable. It is not very convincing to read that abnormalities in the *T* wave usually disappear quickly when associated with pericarditis, but may linger for long periods, and perhaps be always persistent to some degree. The authors' judgement is more valuable when they point out that the electrocardiogram is much more useful evidence when it follows the classical pattern of either myocardial infarction or pericarditis. Another point which perhaps deserves more emphasis is that the anatomical lesion in acute pericarditis involves more or less the superficial parts of the heart itself: the observation that paroxysmal supraventricular tachycardia occurred in two of the nine patients described is worth noting.

This article reminds us that pericarditis may mimic an acute myocardial lesion; fortunately the prognosis is better with the pericardial lesion, but where any doubt exists as to the true nature of the pathological diagnosis the question of anticoagulant treatment should be carefully weighed, particularly where laboratory control is not readily to hand.

[1] *The American Journal of the Medical Sciences*, September, 1951.

MEGALOBLASTIC ANÆMIA AND THE CITROVORUM FACTOR.

A PRELIMINARY COMMUNICATION by L. S. P. Davidson and R. H. Girdwood on the use of citrovorum factor in the treatment of megaloblastic anæmia was mentioned in these columns on June 16, 1951, in a brief general account of this recently isolated, and subsequently synthesized, liver factor. Davidson and Girdwood's initial results suggested that, provided a large enough dose was given, the citrovorum factor would produce a hæmatological and clinical response in patients with pernicious anæmia. Similar encouraging results in the treatment of megaloblastic anæmia have been obtained by a number of other workers, mainly in the United States. These results are quoted by Davidson and Girdwood in a further report[1] of the treatment of patients suffering from megaloblastic anæmia with "Leucovorin", Lederle's preparation of the synthetic form of citrovorum factor, which has recently been said to have the structure 5-formyl-5,6,7,8-tetrahydropteroylglutamic acid. This latest small series consists of nine patients. Six patients with Addisonian pernicious anæmia responded satisfactorily to treatment with "Leucovorin" given either intramuscularly or orally. A similar form of therapy produced an excellent general and hæmatological improvement in two patients suffering from megaloblastic anæmia of pregnancy, who first came under treatment in the puerperium. In one of these cases there was a moderate reticulocyte response to intramuscular injection of vitamin B_{12}, but no change in the marrow picture; in the other preliminary vitamin B_{12} therapy was not possible. The other patient of the series, a woman, aged sixty-seven years, suffering from idiopathic steatorrhœa of four years' duration, responded hæmatologically and clinically to intramuscular "Leucovorin" therapy, but the effects were much less striking than those in the other cases. The results further support the therapeutic possibilities in megaloblastic anæmia of citrovorum factor, which, it has been suggested, may be the derivative of pteroylglutamic acid responsible for the continuance of normoblastic blood formation. It will be remembered that the other reported therapeutic effect of citrovorum factor has been reversal of the toxic effects of folic-acid antagonists.

[1] *The Lancet*, December 29, 1951.

Abstracts from Medical Literature.

DERMATOLOGY.

Foods and Eczematous Dermatitis.

M. B. SUTHRIE AND S. L. MANDEL (*Archives of Dermatology and Syphilology*, April, 1951) present the case histories of ten patients whose dermatological conditions were due to food idiosyncrasies. They state that no attempt is made to prove that food allergy is the most important cause of eczematous eruptions of the skin. Their opinion is that any patient who presents recalcitrant skin reactions which have failed to heal in the expected length of time with good dermatological therapy should be given the benefit of a strict elimination diet such as the one they outline. They state that many drawbacks present themselves, least amongst these being the period required to be spent in hospital and the initial weight loss. They consider that skin tests, both scratch and intradermal, are in the main without value in the over-all handling of these problems.

Para-Aminobenzoic Acid in Dermatitis Herpetiformis.

C. J. D. ZAIAFONETIS, E. B. JOHNWICK, L. W. KIRKMAN AND A. C. CURTIS (*Archives of Dermatology and Syphilology*, January, 1951) report the results of para-aminobenozic acid treatment of *dermatitis herpetiformis*. They state that trial of para-aminobenzoic acid in this disease resulted from the study of its effect in cases of *lupus erythematosus*. *Lupus erythematosus* is often associated with hypersensitivity to sunlight. Similarly, patients receiving sulphonamide drugs not infrequently manifest sunlight sensitivity. Since para-aminobenzoic acid and sulphonamides are metabolite antagonists, it was reasoned that para-aminobenzoic acid might have an opposite and beneficial effect in *lupus erythematosus*. The hypothesis was tested clinically with some encouraging results, so it was decided to try para-aminobenzoic acid in other conditions in which light sensitivity may be a factor. The authors report 16 cases in detail and state that from these it is evident that large doses of para-aminobenzoic acid were followed by partial or complete suppression of *dermatitis herpetiformis* in all cases. The dose required was 18 to 24 grammes a day of potassium para-aminobenzoate or sodium para-aminobenzoate, although control was sometimes achieved with lower doses. The drug suppressed the eruption of new lesions and caused the pruritus to subside. It usually took two or three weeks to obtain the effect. Relapse began to reappear about ten days after cessation of treatment. After reinstitution of treatment two or three weeks were required for suppression of the disorder to be regained. Intermittent treatment would not give adequate control. In some cases control of the disease was obtained with 15 grammes per day. Almost all the patients had had previous forms of treatment for *dermatitis herpetiformis*. Half of them had had toxic symptoms with sulphapyridine. The administrative of para-aminobenzoic acid was maintained for as long as thirty months without serious toxic effects. Nausea and occasional vomiting were the main untoward effects. These usually subsided with omission of the drug for a day or two, whereupon treatment could be resumed often without further difficulty. Potassium para-aminobenzoate is tolerated better than the sodium salt. The authors state that other toxic reactions have been noted during para-aminobenzoic acid therapy, but they were not observed in their own cases. Repeated leucocyte studies failed to reveal any cases of agranulocytosis, but the practice of periodic blood checking should not be discarded. The principal complication which may arise during the administration of para-aminobenzoic acid is spontaneous hypoglycæmia. This complication can be avoided by instructing the patient to eat well while taking the drug. If anorexia or nausea occurs, the use of the drug is to be omitted until the patient is eating normally.

Progesterone Therapy in Dermatoses of Pregnancy (Herpes Gestationis).

C. KEATY, P. E. JONES AND J. H. LAMB (*Archives of Dermatology and Syphilology*, June, 1951) state that early lesions observed in *herpes gestationis*, which were sometimes few, were small erythematous papules and vesicles appearing in groups similar to *dermatitis herpetiformis*. Common sites affected were the upper portion of the buttocks, the back, the lower parts of the legs, the abdomen and the forearms. Lesions of purely hepatic or bullous type were not observed in the majority of cases. It is well recognized that the skin lesions may exhibit a tendency to recur with increased severity in successive pregnancies, with grave prognosis for the patient and fœtus, especially in the later stages of pregnancy. Ten patients with pruritic polymorphic eruptions during pregnancy were investigated. Five of the patients had moderate to severe œdema, and four had albuminuria. The blood level of chorionic gonadotropin in seven patients was abnormally elevated during late pregnancy, averaging 31·25 rat units per 100 millilitres of blood (normal 500 to 750 rat units per 100 millilitres). Progesterone ("Proluton") in doses of 25 to 50 milligrammes daily was administered to the ten patients with resultant remission of skin lesions in all cases. All ten pregnancies terminated in the birth of living normal infants.

Treatment of Seborrhœic Dermatitis with a Shampoo Containing Selenium Disulphide.

W. N. SLINGER AND D. M. HUBBARD (*Archives of Dermatology and Syphilology*, July, 1951) state that in the search for newer and more efficient substances in the topical treatment of the seborrhœic dermatoses, selenium was considered for therapeutic trial because of its general properties and the group relationship of sulphur and selenium. In view of the many toxic effects of selenium described in the literature, the authors decided to use a moderately stable preparation of selenium disulphide in 2·5% strength in a shampoo. Clinical observations were made first on animals and then on human volunteers. The results indicated that the shampoo could be employed without risk under appropriate conditions. Patch tests were performed on 100 normal persons, without detection of evidence of sensitization. The authors state that investigations on the absorption and excretion of selenium have indicated that selenium is eliminated chiefly in the urine. The shampoo containing selenium disulphide was used for from one to seven months by 90 patients with seborrhœa of the scalp without inducing signs of irritation, sensitization or toxicity. In 81% of cases the condition was controlled completely by the use of the shampoo.

Dermatitis and Secondary Leucoderma from Fabric-Lined Rubber Gloves.

L. BOTVINICK (*Archives of Dermatology and Syphilology*, March, 1951) states that dermatitis due to synthetic rubber gloves is infrequent. In cases of so-called housewife's eczema of the hands, dermatologists frequently recommend the use of cotton-lined or fabric-lined gloves for household chores. The history is given of a white woman who acquired severe contact dermatitis followed by transitory leucoderma after the use of lined gloves of this type. The dermatitis and leucoderma were reproduced by patch tests with the material from the gloves. Laboratory tests revealed the presence of "Age Rite Alba", or monobenzyl ether of hydroquinone, in one of the gloves. The dermatitis was aggravated by contact with natural "Latex" rubber gloves.

Oral Use of Procaine and Ascorbic Acid.

H. LUDDECKE (*Archives of Dermatology and Syphilology*, July, 1951) states that for several years procaine has been given intravenously, with success in many cases, for the treatment of pruritus, *status asthmaticus* and serum sickness. He reports the use of procaine hydrochloride and ascorbic acid by mouth in the treatment of various disorders, many of which had an allergic background. Three representative case records are given. Tablets were used containing a mixture of procaine hydrochloride 200 milligrammes and ascorbic acid 150 milligrammes; two tablets were given every four hours for six doses, followed by one every six hours. The ten patients treated were suffering from pruritus associated with atopic dermatitis, penicillin reaction, urticaria, urticaria of unknown cause, and contact dermatitis. In the only case of intolerance a pronounced exacerbation of symptoms occurred after the fourth dose. Most patients experienced relief from the pruritus in forty-eight hours. The author has tried various drugs, such as ephedrine and methapyridine, in combination with procaine. He is now setting as a standard on a product containing 250 milligrammes of procaine hydrochloride and 150 milligrammes of ascorbic acid per tablet.

Prognosis of Dermatitis Herpetiformis.

W. H. EYSTER, JUNIOR, AND R. R. KIERLAND (*Archives of Dermatology and Syphilology*, July, 1951) state that the records of 381 patients who had *dermatitis herpetiformis* and were treated at the Mayo Clinic over a twenty-year period, were examined, and a follow-up *questionnaire* was sent to each inquiring as to the present status of the disease. In the authors' clinical practice the incidence of *derma-*

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titis herpetiformis was 1 in 500 dermatological patients examined. Most patients with *dermatitis herpetiformis* first developed the complaint in early adulthood, although the age at onset ranged from six months to seventy-eight years. There were moderate to intense symptoms at the onset; then, after ten or more years, tapering off of the cutaneous manifestations and perhaps eventual disappearance. In a quarter of the cases the symptoms were severest in the summertime. Eosinophilia was the most consistent blood change; this was of a low order, counts of more than 10% being unusual. Sensitivity to halogens (iodine and bromide) was demonstrated by patients suffering from *dermatitis herpetiformis*, but was not constant enough to be of diagnostic value. In approximately a third of the authors' cases included in this study there was a pronounced psychogenic factor recognized by the patient or the examining physician. The authors state that until the advent of the sulphonamides treatment was inadequate or resulted in undesirable sequelæ. Sulphonamides control the disease, but do not cure it. One-third of the patients receiving potassium arsenite solution were found to have stigmata of chronic arsenism.

UROLOGY.

Terramycin for Refractory Urinary Tract Infections.

R. M. NESBIT, J. ADCOCK, W. C. BAUM AND C. R. OWEN (*The Journal of Urology*, February, 1951) describe in detail their experiences with 24 cases of urinary tract infection in which treatment was with terramycin, after previous failures with other forms of therapy. They state that terramycin is an antimicrobial agent derived from a soil actinomycete. The material possesses a low degree of toxicity in experimental animals. The hydrochloride is a light yellow powder, administered by mouth in capsules which contain the equivalent, in biological activity, of 250 milligrammes of pure terramycin base. Relatively large doses were deliberately employed, since an evaluation of possible toxicity was one of the objects of the study. An initial single dose of 2·0 grammes was followed at six-hour intervals by 1·0 or 1·5 grammes. The duration of therapy was for a minimum of one week, but often more. In three cases out of the 24 there was moderately severe nausea with vomiting, necessitating curtailment of the course at such doses. All the patients had had infection of long duration and many had mixed infections. The drug was not used in any case in which major obstructive, calculous or neoplastic disease was present. However, objective evidence of chronic inflammatory disease was found in the bladder by cystoscopy or in the kidneys by pyelography. Since these infections had proved intractable to other chemotherapeutic agents and antibiotics, the test was a severe one for this new antibiotic. The final impression of the authors is that terramycin is as good as, and may in the future prove to be superior to, other antibiotic agents in some types of infection. They state that it was surprising to find such a satisfactory response with *Pseudomonas aeruginosa* (*Bacillus pyocyaneus*), a germ notoriously insensitive to practically all previously used agents. The experiments also show that terramycin is a relatively non-toxic agent. Out of the 24 cases, resistance was present from the start in four; prompt and satisfactory improvement occurred in 10, but relapse followed withdrawal of the antibiotic. In 10 cases the initial infection was controlled and remained controlled.

Pregnancy and Labour with Pelvic Ectopic Kidney.

G. W. ANDERSON, G. G. RICE AND B. A. HARRIS, JUNIOR (*The Journal of Urology*, May, 1951), have made a study of 98 cases of pregnancy associated with pelvic ectopic kidney, with 14 additional cases observed in the Johns Hopkins Hospital between 1927 and 1948. In the whole 112 cases there were 209 full-term deliveries. Thirty infants died, a fœtal mortality of 14·3%. The method of delivery was spontaneous in 73·2%, Cæsarean section in 17%, and various other instrumental vaginal methods in the rest. The fœtal mortality with spontaneous delivery was 8·4%, compared with 9·3% with Cæsarean section. Unilateral ectopic pelvic kidney occurred once in 4888 pregnant women, while bilateral ectopic pelvic kidney occurred only once in 34,206 deliveries. The authors state that the diagnosis and treatment of the condition during pregnancy depend on thorough pelvic examinations during pregnancy, as well as complete urological examination when necessary. X-ray pelvimetry is imperative to decide whether the patient has adequate pelvic capacity for both the kidney and passage of the fœtal head. During labour, ectopic kidneys which possess any degree of mobility tend to rise out of the pelvis as the fœtal head advances. Cæsarean section should be performed when necessary, but most of the patients can be delivered vaginally.

Occlusion of Renal Artery with Hypertension.

S. MALISOFF AND M. B. MACHT (*The Journal of Urology*, March, 1951) report what they claim to be the only case yet described of thromboangiitis causing occlusion of one renal artery in a woman with resultant severe hypertension and complete relief by nephrectomy. This relief has lasted for twelve months after operation, as proved by a very recent check. The patient was a woman, aged thirty-four years, with a four-year history of *thromboangiitis obliterans* in the lower extremities. Her more recent complaint was sharp pain in the right lower quadrant of the abdomen, thought at first to be due to appendicitis. Her blood pressure was 190 millimetres of mercury (systolic) and 110 millimetres (diastolic) on admission to hospital, but it rose next day to 230 millimetres of mercury (systolic) and 130 millimetres (diastolic) with more severe pain now in the right flank. She was given anticoagulant therapy on account of her old history, but without relief, and on the fifth hospital day the blood pressure was 240 millimetres of mercury (systolic) and 130 millimetres (diastolic), with agonizing severe right occipital headache. A little before this, excretion urograms had shown a non-functioning right kidney. Some fluid was excreted by this kidney, but it was heavy with albumin. The right retrograde pyelogram was normal. Based on the history, the non-visualization of excretion by urography, the normal right retrograde pyelogram and the fulminating hypertension, the authors made a pre-operative diagnosis of thrombosis of the right renal artery, with renal ischæmia and resultant hypertension. Thereupon right nephrectomy was decided upon. The kidney was small, but otherwise not unusual in appearance. On palpation, the renal artery felt as hard as a pencil and about 1·5 centimetres in diameter. The renal vein seemed normal. At the beginning of the operation the blood pressure was 240 millimetres of mercury (systolic) and 140 millimetres (diastolic). Shortly after ligation of the pedicle it dropped to 125 millimetres of mercury (systolic) and 70 millimetres (diastolic), and four hours later it was 72 millimetres of mercury (systolic) and 30 millimetres (diastolic). The patient was then given plasma, followed by glucose-in-saline solution, to combat secondary peripheral vascular collapse. She rallied quickly, and that evening the pressure was stabilized at 120 millimetres of mercury (systolic) and 70 millimetres (diastolic). She did well after this. The lumen of the artery was found to be extremely narrowed by fibrosis between the muscle fibres of the *tunica media*. The vein was hardly affected. Examination of sections of the kidney revealed intimal fibrosis in the vessels with variable luminal narrowing, a good deal of cellular degeneration in the tubules and some interstitial fibrosis. The glomeruli were hardly affected.

Hydronephrosis in Infants and Children.

MEREDITH CAMPBELL (*The Journal of Urology*, May, 1951) states that hydronephrosis is the commonest abdominal tumour in childhood and usually results from congenital causes. The pathological changes are pelvi-calyceal dilatation, parenchymal thinning and sclerosis of the secreting elements. The commonest clinical manifestation is persistent pyuria, too often diagnosed as due to "chronic pyelitis", and both investigated and treated inadequately. Less frequently the appearance of a mass or of pain in the loin directs attention to the lesion. Acute exacerbation of smouldering infection in hydronephrosis causes a diagnosis of "persistent pyelitis" to be made. Indications for a complete urological examination are many in children suffering from hydronephrosis, but the usual symptoms are pain or a mass in the loin or abdomen, pyuria (persistent or acute), hæmaturia and reflex vesical disturbances. The diagnosis is readily suggested by excretion urograms, and can be made absolute by retrograde pyelograms, preferably bilateral. Treatment is according to the specific surgical indication, and occasionally conservative therapy by instrumental dilatation is successful. In most cases, however, operation is necessary, but this may often be of a conservative type. Yet in one-third to one-half of the children in whom hydronephrosis is diagnosed, the degree of renal damage calls for total nephrectomy.

Special Articles for the Clinician.

(CONTRIBUTED BY REQUEST.)

IV.

NUTRITION IN HEALTH.

" . . . it is clear that the key person concerned in the utilization of the contribution which the science of nutrition can make in the preservation of health and the control of disease is the doctor. The educationist can pull his weight by teaching the fundamental principles of nutrition in relation to physiology and chemistry. The industrialist can make his contribution through the factory canteen and the welfare service. But the opportunity given by the "close-up" of the doctor and his patient in this regard is unequalled in any other walk of life, even if, as in the past, the doctor has concerned himself more with the prohibition of particular articles of diet than with the provision of positive advice."—Report of the Committee on Nutrition (British Medical Association, London, 1950).

Patterns of Food Procurement.

NEXT in importance to a supply of oxygen and water, man's most urgent need is food. Food is procured by human activity, whether it be the hunting, fishing and food collecting of the Eskimo and the Australian aboriginal, the animal husbandry of the Central Asian nomad, the shifting agriculture of the New Guinea native, the fixed subsistence farming of people of South East Asia, or the modern specialized commercial farming of Australia.

The most important factors determining these different methods of food procurement are those of soil, climate and terrain. It must not be assumed that our methods of food production and distribution are always the best, and that they can be satisfactorily applied to circumstances other than our own. For instance, the rugged mountainous nature of the terrain alone renders trade in foodstuffs difficult in inland New Guinea, even if the crops are not bulky and perishable (as they are). The frigid climate in extreme north and south latitudes and the semi-arid climate of parts of Australia both render soil cultivation impossible.

In the agricultural systems which do not depend on trade there is usually a minimum of food processing and storage. This means that there is less likelihood of interference with the nutrient content of the whole food, and consequently specific vitamin deficiency diseases are rare. However, such economic systems lack reserves and there is always the possibility of famine following local crop failure.

In the more highly organized mercantile systems of food procurement (such as the Australian system), which involve food preservation and transport, a relative immunity to famine can be achieved by stock-piling food. Furthermore, people can operate enterprises at great distances from their source of food supplies.

The processing of foodstuffs required for their preservation and transport often affects the nutritive value, as, for example, happens in the case of rice, sugar, flour, salt and vegetables *et cetera*. Hunger is an excellent guide to the biological need for energy foodstuffs, but there is no sound evidence that appetite is a guide to "nutritional wisdom", that is, can be trusted to secure an adequate assortment of nutrients. This probably arises from the fact that during the evolution of man it has never been necessary to evolve a food-selection mechanism which takes into account food technology with all its potentiality for confusing human choice of food. Habit and training enter largely into appetite. Travellers in foreign countries are well aware of the extent to which food habits and preferences differ from their own. It is apparent from the foregoing that sound nutritional education, based on a knowledge of the nutrient composition of foodstuffs and their requirements for health, is essential to the health and efficiency of any modern civilization. In the selection of both the quality and the quantity of the diet it would be unwise to rely on either instinct or habits, unless the habits were based on sound nutritional principles. Therefore it is a primary task of nutrition education to base these food habits on sound principles.

Dietary Standards.

Although ration scales for foodstuffs have been used from time immemorial, requirements for nutrients are a matter of comparatively recent history. In 1753 Lind published his treatise on the prevention of scurvy, but it was not until 1796 that the provision of lemon juice, known as "lime juice", for the navy was introduced, and not until 1835 that the *Merchant Seaman's Act* made compulsory the issue of "lime juice" to merchant sailors. This might be considered the first attempt to control deficiency disease by setting down minimum requirement for a nutrient; in this case it was a foodstuff rich in a specific nutrient—ascorbic acid.

TABLE I.

Daily Calorie Allowances for Adults.

(Extracted from Table I (*b*) of the Report of the Committee on Nutrition (British Medical Association, London, 1950).)

Requirement Class.	Description.	Calorie Requirement.
Men—		
0	No work, almost basal (for example, lying in bed)	1750
1	Sedentary work (30 Calories per hour) and little travelling (65 Calories)	2250
2	Light work (70 Calories per hour) and travelling (130 Calories)	2750
3	Medium work (100 Calories per hour) and travelling (130 Calories)	3000
4	Heavy work (200 Calories per hour) and travelling (130 Calories)	3500
5	Very heavy work (300 Calories per hour) and travelling (130 Calories)	4250
6	Extremely heavy work (450 Calories per hour) and travelling (130 Calories)	5000
Women—		
0	No work, almost basal (for example, lying in bed)	1500
1	Sedentary work (30 Calories per hour) and little travelling (50 Calories)	2000
2	Light work (70 Calories per hour) and travelling (100 Calories)	2250
3	Medium work (100 Calories per hour) and travelling (100 Calories)	2500
4	Heavy work (200 Calories per hour) and travelling (200 Calories)	3000
5	Very heavy work (300 Calories per hour) and travelling (100 Calories)	3750

Since that time there has been a gradual accumulation of knowledge of the chemistry of foodstuffs or nutrient constituents on the one hand, and of their metabolic role and relationship to health and disease on the other. Even today this knowledge is far from complete and is constantly being added to and revised. It is, however, of such great practical value that we are forced to utilize the broad conclusions, incomplete and possibly erroneous though they may be at the present time.

From about 1870 to 1901 a number of investigators determined dietary standards based on analyses of the habitual diets of groups of men. In few cases was any account taken of the health of individuals whose diets were surveyed. When these data are reviewed it is obvious that both Calorie and protein intake varied with the nature of the work and with the kind of food available.

It has been mentioned previously that the dietary pattern is determined by habit, by economic status and by local agricultural practice. Any standards of food requirements based solely on survey data lack scientific basis. They reflect external circumstances and not fundamental needs. For example, hunting people such as the Eskimo and the Australian aboriginal derive a larger percentage of Calories from protein than do the agricultural people of New Guinea.

Tables of Recommended Allowances.

The first attempt to recommend allowances of nutrients including vitamins and minerals for each age group was not made until as late as 1941 by the National Research Council (United States of America). This was only then rendered possible by the vast knowledge of accessory dietary factors, their metabolic role, and their distribution in various foodstuffs, which had been accumulated in the previous ten years. It was not claimed that the figures represented the physiological requirements of the individual, but rather a tentative goal towards which to aim in planning practical dietetics. In all instances the figures were calculated with wide safety margins.

These "Tables of Recommended Allowances" were modified in 1945 and again in 1948.

Experience in the United Kingdom had shown that somewhat lower levels of intake of minerals and vitamins are

TABLE II.

Summary of Recommended Dietary Allowances.

(Extracted from Table 1 (c) of the Report of the Committee on Nutrition (British Medical Association, London, 1950).)

Age (Years) and Sex or Condition.	Requirement Class.	Calories Daily.	Protein. (Grammes Daily.)	Iron. (Milligrammes Daily.)	Calcium. (Grammes Daily.)	Vitamin *A* and Carotene. (International Units Daily.)	Vitamin *D* (International Units Daily.)	Thiamine. (Milligrammes Daily.)	Niacin. (Milligrammes Daily.)	Riboflavin (Milligrammes Daily.)	Vitamin *C*. (Milligrammes Daily.)	Iodine. (Microgrammes Daily.)
Both:												
0 to 1	—	1000	37	6·5	1·0	3000	800	0·4	4	0·6	10	—
2 to 6	—	1500	56	7·5	1·0	3000	400	0·6	6	0·9	15	150
7 to 10	—	2000	74	10·5	1·0	3000	400	0·8	8	1·2	20	150
Males:												
11 to 14	—	2750	102	13·5	1·3	3000	400	1·1	11	1·6	30	150
15 to 19	—	3500	130	15·0	1·4	5000	400	1·4	14	2·1	30	150
20+ ..	0	1750	51	12·0	0·8	5000	—	0·7	7	1·0	20	100
	1	2250	66	12·0	0·8	5000	—	0·9	9	1·4	20	100
	2	2750	80	12·0	0·8	5000	—	1·1	11	1·6	20	100
	3	3000	87	12·0	0·8	5000	—	1·2	12	1·8	20	100
	4	3500	102	12·0	0·8	5000	—	1·4	14	2·1	20	100
	5	4250	124	12·0	0·8	5000	—	1·7	17	2·6	20	100
	6	5000	146	12·0	0·8	5000	—	2·0	20	3·0	20	100
Females:												
11 to 14	—	2750	102	13·5	1·2	3000	400	1·1	11	1·6	30	150
15 to 19	—	2500	93	15·0	1·1	5000	400	1·0	10	1·5	30	150
20+ ..	0	1500	44	12·0	0·8	5000	—	0·6	6	0·9	20	100
	1	2000	58	12·0	0·8	5000	—	0·8	8	1·2	20	100
	2	2250	66	12·0	0·8	5000	—	0·9	9	1·4	20	100
	3	2500	73	12·0	0·8	5000	—	1·0	10	1·5	20	100
	4	3000	87	12·0	0·8	5000	—	1·2	12	1·8	20	100
	5	3750	109	12·0	0·8	5000	—	1·5	15	2·2	20	100
Pregnancy:												
First half	—	2500	93	12·0	0·8	6000	400	1·0	10	1·5	40	150
Second half	—	2750	102	15·0	1·5	6000	600	1·1	11	1·6	40	150
Lactation ..	—	3000	111	15·0	2·0	8000	800	1·4	14	2·1	50	150

compatible with a good state of health, and for this reason (restricted) tables of recommended dietary allowances have been used widely in the United Kingdom and in Australia since 1944. The (restricted) values are the National Council (United States of America) figures for Calories and protein in all cases and for minerals and vitamins in respect of the groups up to the age of twenty years and expectant and nursing mothers, and 70% of the National Research Council allowances for minerals and vitamins for adult men and women.

Nutrition Requirements: British Medical Association Report (1950).

In 1950 a special Nutrition Committee appointed by the Council of the British Medical Association, published a comprehensive report on the nutrition of Britain which included a section dealing with nutritional requirements for health. The requirements suggested by the British Medical Association Committee differ in some respects from the National Research Council (United States of America) recommended dietary allowances (1948), the most important differences being as follows:

Calories.—Broadly the figures agree with those recommended by the National Research Council (1948), but additional groupings have been made to differentiate more closely between levels of activity (Table I). Seven levels for men, ranging from "no work" to "extremely heavy work", and six for women are given.

Protein.—Requirements for protein are given in relation to Calorie intake. This method of computation differs funda-

TABLE III.

Recommended Allowances of Foodstuffs: Moderate Cost.

(Per week: in pounds.) (Figures in parentheses show approximate number of ounces per day.)

Foodstuff (as Purchased).	Adult.		Adolescent. 12 to 15 Years.	Child.	
	Heavy Work.	Moderate Work.		6 to 12 Years.	Under 6 Years.
1. Milk pints (or equivalent dry)	5·25 (0·75)	5·25 (0·75)	10·5 (1·5)	7 (1)	10·5 (1·5)
Or cheese	3 ounces equivalent to 1 pint.				
2. Butter	0·6 (1·3)	0·5 (1)	0·5 (1)	0·375 (0·5)	0·25 (0·5)
Other fats		As required.			
3. Eggs (number) (more if available) ..	3–5	3–5	3–5	3–5	3–5
4. Meat, fish *et cetera*	4 (9)	3 (7)	3 (7)	2 (4)	1 (2)
5. Potatoes	4 (9)	2·75 (6)	2·75 (6)	2 (4)	1·5 (3)
Other vegetables	3·5 (8)	3 (7)	3 (7)	2·5 (6)	1·75 (4)
6. Fruit:					
Oranges (number)	4	4	4	4	4
Or tomatoes (pounds)	2 (5)	2 (5)	2 (5)	2 (5)	2 (5)
Or pawpaw (pounds)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)
Other fruit (number)	3	3	3	3	3
7. Bread	4–7 (9–16)	4–5– (9–11)	4–7 (9–16)	2–4 (5–9)	1–2 (2–5)
8. Oatmeal, wheatmeal, flour and other cereals	1·5 (3)	1·25 (3) According to appetite	1·5 (3)	1 (2)	0·5 (1)
9. Extras: bread, jam, sugar *et cetera* ..		According to appetite			

Note.—Three-quarters of a pound of cheese or one dozen eggs may be substituted for one pound of meat, or *vice versa*. If extra money is available it should be spent on more fruit and more eggs.

mentally from previous recommendations which have been based on body weight. The main reason for adopting the new method is given in the words of the British Medical Association Report:

> On the whole, people eat more or less of a mixed diet according to energy requirement. Although the requirement of protein is related to sex, body size, growth, pregnancy and lactation, but not to physical work, it is convenient to pay regard to the proportion of the total Calories derived from protein.

The proportion of the Calories derived from the protein of the diet is not less than 14% for pregnant and nursing women, infants, children and adolescents, and for other adults not less than 11%.

Vitamin C.—The British Medical Association committee's recommendations are considerably lower than the National Research Council's recommended allowances, which were based on the assumption that maintenance of saturation of the blood with vitamin *C* was desirable in the interests of health. For this assumption the committee was unable to find any trustworthy evidence. Moreover, records of food consumption in the United Kingdom, and in particular a special investigation carried out by the Medical Research Council (British) in 1944-1946, indicated that health could be maintained on the intake of vitamin *C* recommended by the British Medical Association committee.

It is too early to assess the value of the recommendations of the British Medical Association committee, but they deserve serious consideration for adoption in place of the National Research Council (United States of America) recommended dietary allowances (restricted) which have been previously used in Australia in planning and evaluating diets.

Food Composition Tables.

In 1946 the Nutrition Committee of the National Health and Medical Research Council (Australia) published a booklet, "Tables of Composition of Australian Foods", which has become a standard work in Australia for the calculation of the nutrient content of diets. These tables have been made available by the Commonwealth Government, through its Department of Health, to doctors, nursing sisters, dietitians and domestic science teachers. As new information accumulates they are being reviewed and kept up to date.

Recommended Allowances of Foodstuffs.

The National Research Council (United States of America) tables of recommended dietary allowances have been translated in Table III into approximate weekly and daily amounts of foodstuffs, regard being paid to the range of foods available in Australia and the traditional diet pattern. In Table IV the foodstuffs are expressed in terms of daily serves. It should be noted that the tables are compiled as "moderate cost" diets.

Where diets have to be provided at a "minimum cost", the amounts of eggs, meat and butter can be reduced to certain levels; this would affect the palatability but not the nutritional adequacy of the diet. Where expense need not be considered, the amounts of eggs, cheese, meat and fruit can be increased and the palatability enhanced.

The relationships of nutrition to deficiency diseases such as scurvy, beriberi, pellagra, night blindness *et cetera* are too well known to warrant further treatment here, but questions at the front of everyone's mind are, how far can nutrition influence susceptibility to infectious diseases? And, can nutrition influence the development of metabolic and degenerative diseases?

Nutrition and Susceptibility to Infection.

It is a time-honoured belief that malnutrition decreases resistance to infectious disease, but the hard fact is that whilst this may be true in the case of some infectious diseases, it certainly is not true for all.

The position has been well reviewed by Schneider (1946). Research in this field is extremely complicated and difficult, but it is apparent that there is no such thing as "panresistance" which, for instance, can be achieved by good nutrition. It is only comparatively recently that nutrition has been studied in its relationship with infectious diseases, and it is certain that time will show that many important relationships do in fact exist, but it is probable that "better nutrition" may not always mean "more resistance", however ardently we may hope that it does. This does not imply that we should slacken our striving for better nutrition, for there are many good reasons why we should not, but it does mean that nutrition cannot provide the panacea for all the ills that afflict mankind—a fantastic claim that is often made.

Nutrition and Metabolic and Degenerative Diseases.

On examination of the field of possible relationships between nutrition and the development of many metabolic and degenerative diseases, it is evident that although exploration of this field has barely commenced, important discoveries will most probably be made. It has long been noted that some diseases common in one pattern of existence are absent or rare in people living another way of life;

TABLE IV.

Recommended Daily Serves of Food Groups: Moderate Cost.

Type of Food.	Quantity.
Milk and milk products (powdered milk, cheese and milk puddings).	1 to 1·5 pints for children. 1·5 to 2·0 pints for expectant and nursing mothers. 0·75 pint for adults. To drink and combined with other foods.
Meat, fish and eggs	At least one serving of meat or fish. 3 to 5 eggs per week.
Fruit (orange, tomatoes and pawpaw are rich in vitamin *C*).	1 piece or more—any variety.
Vegetables (especially carrots and greens).	2 or more beside potato (fresh, tinned or frozen).
Bread and cereals. Brown or wholemeal bread preferably. Wholegrain porridges (oatmeal, wheatmeal).	As required.
Butter (including fortified margarine)	0·5 to 1 ounce.

and it has been suspected that differences in diet may sometimes be responsible. This view has been strengthened when instances are noted in which a previously uncommon disease has become common following a change in diet, or *vice versa*. For example, dental caries has often increased in populations following a change in diet (Price, 1939); the incidence of hypertension has been observed to decrease during periods of caloric restriction (Brozek, Chapman and Keys, 1948); pregnancy toxæmia shows a marked geographical distribution suggesting an association with diet (Dieckmann, 1941); and Wilens (1947) has published data showing a relationship between atherosclerosis and obesity. There is ample evidence that overweight (which is closely related to over-nutrition) is associated with an increased mortality, especially if it occurs in the latter part of life (Dublin and Lotka, 1936). This increased mortality appears to be due mainly to cerebral hæmorrhage, nephritis and diabetes.

In animal experiments Tannenbaum (1942) has shown that the incidence of mouse cancers is adversely affected by over-nutrition. In another study McCay and his group (1947) found that by restricting the caloric intake of rats whilst maintaining the diets adequate in essential nutrients, many more animals reached old age than those with adequate but unrestricted diets.

There are good reasons for believing that further research will reveal spectacular development in practical measures to prevent many metabolic and degenerative diseases by dietary manipulation; but again we should not be too ready to assume that "more" food is necessarily "better".

The Humus Controversy.

It is claimed by some that foods grown on soils manured with composted animal and vegetable wastes have health-giving properties superior to similar foods grown on soils manured with chemicals. At the present time there is very little soundly based evidence either to credit or discredit this claim, and therefore it would be wise to await the results of further investigations before stating a definite opinion.

It is true that good yields result more often where plants are grown on composted soils, but this can be explained by the superior moisture-holding and other physical properties of the soil.

Food Distribution and the World Food Crisis.

It is commonplace knowledge that the world in our generation faces a great crisis in food supply. It cannot be expected that Australia will escape, especially when one

considers our British associations and the responsibilities they entail. Therefore this essay would be incomplete without mention of the possible impact of the world food shortage on the public health approach to nutrition.

In the history of mankind the control of food distribution by family, tribal, or by national council has often been necessary, especially during food shortages. Planned rations have long been a characteristic of armies, ships, schools, hospitals and other institutions associated with community life.

During the second World War, State planning of food distribution (and production) became very highly developed in the United Kingdom. In Australia it has so far been of relatively minor importance. Nevertheless, planned food distribution operated in this country by means of rationing and subsidy of some items. There has been some relaxation of controls since the war, but expanding population, restriction of imports by political unrest overseas, and the necessity for maintaining a high level of exports of primary products to pay for essential imports, all make it probable that State planning of food distribution may become more important in the future.

In the United Kingdom the system of food distribution aims at giving to every individual in the State the opportunity for obtaining an adequate diet. The methods used to bring this about include "straight" rationing, "points" rationing, priority consumer schemes, welfare foods (for mothers and young infants), school meals, industrial canteens, and control of food prices by subsidy. Other measures include regulations to control the nutrient quality (national high-extraction flour) and fortification of foods with essential nutrients (for example, addition of vitamin *A* to margarine and iodine to domestic salt).

These methods for controlling food distribution cannot guarantee a satisfactory standard of nutrition for everybody in the community. The unpleasant sequelæ of ignorance, indifference and poverty depend partly on individual good fortune and effort, and although methods are often devised whereby the greatest opportunity is given to all to obtain a satisfactory diet, individual circumstances sometimes render this impossible.

Summary.

An outline is given of the different patterns of food procurement and the ways in which they can affect nutrition. The need for correctly informed nutrition education is stressed. Some tables of recommended dietary allowances are given together with tables showing approximate daily and weekly quantities of foodstuffs which would provide a palatable diet of moderate cost conforming with these standards. The relationship of nutrition to the preservation of health is briefly discussed. Good nutrition is not a panacea which will guarantee freedom from disease (especially the infectious diseases), but the indications are that it will make important contributions to the prevention of some metabolic and degenerative diseases. Brief mention is made of the possible effects of the world shortage of food on the procurement of our daily food requirements.

Acknowledgement.

Miss Winifred Wilson, Senior Nutritionist, Commonwealth Department of Health, prepared Tables III and IV, giving recommended (approximate) daily and weekly allowances and serves of foodstuffs.

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British Medical Association News.

SCIENTIFIC.

A MEETING of the New South Wales Branch of the British Medical Association was held at Broughton Hall Psychiatric Clinic, Leichhardt, on November 22, 1951. The meeting took the form of a series of clinical demonstrations and discussion by members of the medical staff of the clinic. Part of this report appeared in the issue of January 12, 1952.

Agitated Melancholia.

DR. H. J. PRIOR presented a married man, aged fifty-four years, with no children, who had been admitted to the clinic in September, 1951, because for some time he had been acutely depressed, with extreme agitation and a considerable anxiety element. He was self-pitying, lived in the past and stated that his life had been one long breakdown. He had had no interests except his own miseries, and those he never forgot. He felt hopeless, and said that nobody had ever been so mentally ill. He talked freely about suicide. He had had several previous attacks, and had made two attempts to commit suicide. He could not concentrate, and his mental drive was all in the non-useful direction—so much so that he had been unable to carry on his work as a clerk. It was considered that he was now past the stage when he would be able to regain his social balance and take up the work for which he had been trained. Examination of his family history revealed that his mother had been afflicted with mental illness and had been severely depressed. One brother was an alcoholic, another a diabetic and a third mentally unstable. One sister was unstable and paranoid, the other had died in infancy. The patient himself had been a nervous youth, much addicted to masturbation, and to that he attributed all his present troubles. He felt that people must know about his secret vice, which had resulted in severe backache, and after his father's death in 1937 he had become sexually impotent, and that had made matters much worse. In spite of that serious trouble he had married and had been a very unsuccessful male partner. However, his wife had known of his condition prior to their marriage, and she was making the best of things. She was in constant work. On previous occasions electroconvulsive therapy had been of use for the patient, but the relief was only temporary, and on the present occasion it had failed. He was being given a course of carbon dioxide and oxygen gas therapy in an attempt to relieve his tension. It was considered that the treatment might serve to alleviate the factor of anxiety present, and in other cases it had been of help for impotent males. Dr. Prior commented that the case was one of recurrent melancholia in a man whose heredity had been shown to be psychopathic. His personality was immature, and in seeking some factor to blame for his illness he had selected the only vice to which he had been addicted. His outlook was very poor, and yet he represented but one of a great number of similarly affected males.

DR. GUY LAWRANCE presented a single woman, a pensioner, aged fifty-one years, who had been admitted to the clinic in July, 1951, because eighteen months previously she had been threatened with the loss of her pension, which alarmed her. Three months later she had lost the pension, and worked in a shop for three months. Then she went to bed, became very depressed and anxious and was very restless and unsettled. She said that she was dying, that her head lifted and was full of pressure, that her feelings had gone, that she was living on her nerves and was smothering, that her legs were paralysed, that she had to be doing something all the time, and that her bowels were blocked. She wanted to feel people all the time, and she did not eat or sleep. Her sister gave her four eggs a day and a good deal of brandy. At that stage she was admitted to the clinic.

Electroconvulsive therapy did not help her at the time. Examination of the family history showed that the patient was the fifth in a family of six siblings, whose father had been killed when the eldest child was aged fifteen years. She had had a hard life, and had worked at various jobs after her mother had died when the patient was aged fourteen years. At the age of thirty-one years the patient had had a breakdown and subsequently received an invalid pension. Her brother was an alcoholic who was demented, and one sister appeared to be congenitally mentally deficient. Dr. Lawrance said that the case was one of agitated melancholia in a woman who had been predisposed by previous mental illness. She was unable to fend for herself, and relied upon the pension for money. That had been restored to her, but she had become no better as a result. She had now had her menopause, and that possibly was a factor in her illness. It was difficult to ease her state of tension. Electroconvulsive therapy and carbon dioxide therapy had failed, and the prognosis was very poor.

Arterial Hypertension and Personality.

Dr. Lawrance presented three patients to illustrate the relationship between arterial hypertension and personality. He said that in the course of routine physical examination of patients admitted to the clinic, it had been found that female patients whose ages had been within the involutional epoch had raised blood pressures. By plotting on a graph blood pressure against age for male and female patients respectively, it was found that for female patients a steep ascent in the curve commenced in the fifth decade, but for males such an ascent was not observed for another ten or fifteen years. It would seem that during the female involutional period there was some factor operating which conduced to hyperpiesis. The patients presented illustrated the frequency of hyperpiesis among female patients at the clinic. They represented about 12% of the female patients under treatment, whereas 3% of the male patients were hyperpietics. From the psychiatric point of view there was no specific syndrome associated with hyperpiesis. In many cases the condition was discovered only in the course of routine examination, and was not related causally to the patient's symptoms. Perhaps the most frequently encountered and most directly produced psychiatric manifestation of hyperpiesis was some type of anxiety state. Such states represented the patient's emotional reactions to such physical disturbances as precordial pain, palpitation or dizziness. It had been said that patients suffered more from the knowledge that they had high blood pressure than from the condition itself. Patients with hypertensive anxiety states responded well to rest, mild sedation and psychotherapy. If the depressive factor was severe, subconvulsive electroconvulsive therapy was often of use. Gregory Gressel and others had found in 1948 that personality malfunctioning was unusually frequent in hypertensive subjects. The general pattern of maladjustment in interpersonal relations in such persons had been considered to be unexpressed or displaced hostility, continued emotional lability with frequent depression, anxiety or both, chronic anxiety, perfectionism, compulsiveness and difficulty with authority.

The first patient in the group was a married woman, aged fifty-eight years, with two children, who had been admitted to the clinic in September, 1951, because she had become anergic and depressed, could not concentrate and had been sitting idly about the house. Her memory was poor and she could take no interest in anything. She felt that her bowels had stopped permanently. In telling her story she kept on repeating herself. A month previously she had undergone hysterectomy for fibroid tumours. Her blood pressure was raised, the readings being 200 millimetres of mercury, systolic, and 110 millimetres, diastolic, but the vessels were soft-walled and an electrocardiogram revealed no contraindication to some form of dynamic treatment. Investigation of her family history revealed that her mother had been deserted by the father and left to rear two boys and three girls. Life had been hard, and rather strict and narrow and on a superior scale with regard to religion and purity. One brother had hanged himself. The patient had married an equally fussy man, who had treated her well. She had been house-proud and very particular in her appearance and that of her husband and children. She had been wrapped up in her son until he married and she found that she disliked his wife. Now all her affection was for her daughter. She had a worry complex about the house, the shopping and everything else, and finally at a time when she was physically disturbed after the operation, her anxiety and depression gained the mastery and the present illness arose. Dr. Lawrance said that the patient came into the category of the worrying, superior type of hyperpietic woman. The number of these was legion, but many carried on without having an actual breakdown. The breaking point was frequently an operation or a bereavement. The patient was improving satisfactorily with electroconvulsive therapy.

The next patient, a widow, aged sixty-one years, with four children, had been admitted to the clinic in October, 1951, because for several months she had been anxious and depressed. She had been crying and felt that people were against her, and she was lazy. At times she had mild panic attacks. She roamed about somewhat aimlessly, could not sleep and said that something was pressing on her head. She complained of hot flushes, cold feet, constipation and indigestion. She dreamt of coffins and funerals (her husband had been dead for only one year). She was tidy, but had been obliged to give up all her usual interests. Investigation revealed that her mother had been insane, and that twenty years before the time of her admission to the clinic the patient had had a mental illness when a sister of whom she was extremely fond had died. Her early life and her married life had been happy. She was devoted to her children and very possessive. One great grief had been the estrangement of her daughter through quarrels with her husband. Her health had been very fair, but at present she had a blood pressure of 200 millimetres of mercury, systolic, and 105 millimetres, diastolic, with some arteriosclerosis. All her life she had been of the superior type, who must commit no fault. She had been fastidious in every way and house-proud, and consequently had a tremendous amount of extra work to do; otherwise she had lived only for her family, although she never gave too overtly. The precipitating crash had come when her husband died suddenly of coronary occlusion while he was doing his work. Dr. Lawrance said that the case was another illustration of how the person with a superior type of personality could carry on until some severe precipitating factor arose, often an operation or a bereavement, when the whole resistance failed and depression and anxiety came to the surface, bringing about total incapacity. He considered that the patient would probably do very well.

The last patient in the group, a married woman, aged sixty-three years, with one child, had been admitted to the clinic in October, 1951, because she had become very depressed after undergoing operations, first for the removal of her gall-bladder, and secondly for the removal of a stone from the common bile duct. She had noises in the head and insomnia which was relieved only by taking "Medinal". She was in a state of tension and depressed, had bodily tremors, and was so disturbed that she had tried to commit suicide by electrocution, but she picked up the wrong wires. She was extremely restless after that, and her family had to struggle with her. She had had similar attacks in 1944 and 1949, when her blood pressure was 210 millimetres of mercury, systolic, and 110 millimetres, diastolic. At the time of the meeting it was 190 millimetres of mercury, systolic, and 110 millimetres, diastolic. She had glycosuria at times, but the condition was not constant. Her early life had been happy, although the parents were rather strict and repressive, and the children were brought up with many taboos and were always told that they were superior to the neighbours. The patient was always highly strung and fearful of criticism, and had tried to lead a life that would place her beyond reproach. She married a soldier, who had been badly gassed, and she fussed over him all the time. There was one daughter, aged thirty-two years, who was single. The patient's sister suffered in the same way as the patient, and her two brothers were dead. One had diabetes. There had been no intercourse for twelve years, as the husband was above that sort of thing. Dr. Lawrance commented that the patient had a recurrent depressive state associated with hyperpiesia and inconstant glycosuria. She had taken electroconvulsive therapy well, and should make a good recovery from the mental illness provided no arterial catastrophe occurred meanwhile, because soft radial vessels were no indication that the cerebral circulation was healthy. The patient had been a masterful woman and had ruled her husband and daughter firmly. If she did not obtain all the attention she felt was due to her, she became somewhat hysterical and difficult.

Compulsive Neurosis.

Dr. Lawrance presented a married woman, aged thirty-four years, with one child, who had been admitted to the clinic in August, 1951, because of a compulsion to stare at male genitals and at laces *et cetera* on other woman's undergarments. Also a tune kept running in her mind, always from good musical compositions. She expressed a belief that she might have a degree of masculinity, because of hair on her face and legs. She realized that in many ways

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she was a woman. She was rather depressed about it, and was considering suicide as a way out of her troubles. It was found that the patient had never seen her mother, who was insane, and she felt disgusted when she looked at her father, who was a hard, rough type of man with coarse ways and an objection to bathing. Her only brother was mentally defective, and there were no sisters. As a child she had suffered from lack of proper affection and love. Her father had taken her away from school at an early age, although her intelligence quotient was 90, and in her teens she had had a series of unsavoury sexual experiences. At the age of twenty-one years she married, but often rejected her husband because she did not want him to see the hairs on her legs. More recently, in addition to her child and husband, she had been caring for her father, who was old and dirtier in his ways then ever, and a nearly blind old woman, aged eighty years, who had cared for her as a child. She had become exhausted. Her husband did not give her the help and practical affection she had been seeking all her life, and he used *coitus interruptus* regularly. In that dilemma of overwork and worry she had fallen in love with a male welfare officer, who had made efforts to place the old woman in a home. The patient felt guilty over that, and also over the fact that she had had a lover while her husband was away at the war. At that stage her obsessive illness flared up. She knew that when she stared at men in buses and trams it was obvious to all what she was doing, and she felt very depressed. A course of electroconvulsive therapy had removed her depression, but the compulsions continued, and she felt sure that she was over-sexed. Dr. Lawrance commented that all through her life the patient had been exposed to incidents which had raised guilty feelings in her mind. Much of the fear attached to the childhood experiences had probably been repressed, because she was not worried about them now. The compulsions and doubts of the present time were probably the result. Rest and freedom from overwork would restore the patient's body, and it seemed that some remission of symptoms had occurred; but under the urge of her inferiority, and in view of the facts of her early life, her prognosis appeared to be very poor. The case seemed to illustrate the origin of obsessive compulsive states in repressions of affect derived from fear and guilt in childhood, and the later freeing of the repressed libido and its attachment to new objects. The condition was associated with a schizoid basis, and the patient was having full coma insulin therapy.

Mysophobia.

Dr. Lawrance presented a married woman, aged forty-two years, the wife of a traveller, who had been admitted to the clinic in July, 1951, because she had been depressed and agitated and refused her food. She expressed great fear of germs and dust or dirt, and was afraid to visit a toilet. She had also a throbbing sensation in her vulva, which she described as being like a clock ticking. The sensation was intermittent and caused considerable unrest and fear. Dancing appeared to make it worse or even to start it. Her mother and her father, who was a popular alcoholic, had been separated when the patient was aged seven years, and she had been reared by a strict maiden aunt. She had seen her parents at intervals, and appeared to be very fond of her father. Her early life had been as happy as possible under the circumstances. At the age of seven years she had engaged in vulval friction, and had developed chafed parts, which required medical treatment. She had then given up the custom, being much afraid. Premarital coitus was carried on for three years before the patient married at the age of twenty-three years, but she had always regarded intercourse as unnecessary and revolting. There were no children. Her husband lived in the islands, but she spent little time there. She developed an infatuation for a man aged seventy years and gave him her favours. After the man's death she told her husband, and he forgave her. In 1950 she had undergone hysterectomy, which gave her a serious setback. Later in the year the present illness had come on with refusal to eat and depression. At the time of the meeting the patient washed her hands very frequently, washed her teacup soundly and at length before meals, and dusted her plates and eating utensils *ad nauseam*. Toilet trips were of great duration and called for much ceremonial. Her whole life was slowed up. She was unable to concentrate, could not help in such tasks as washing up and the like, and needed much help. "Sodium Pentothal" analysis indicated that she had a strong fixation on her aunt, by whom she was reared. Dr. Lawrance said that one of the commonest origins for obsessive states was childish masturbation with repression of the guilt affect, and the subsequent freeing of that affect later in life. The patient's amours and her operation with its subsequent debility had been sufficient to cause emotional difficulties leading to the easing of the repressing forces and the resultant appearance of obsessive symptoms. The handling of such patients was very difficult, and well-established obsessions offered a very serious problem. The patient was fully conscious of great remorse and guilt because of her association with the elderly man. The only hope for her was full scale psychotherapy.

The last patient, a married woman, aged thirty-five years, with three children, had been admitted to the clinic in February, 1951, because for six months she had had an obsession about cleanliness, and had washed her hands very often, in addition to a complete washing of her blankets, sheets and towels every day. She had tremor of the limbs, and was unable to run her home or mind her children, and all her useful activities had slowed up. She was the youngest of five children and had been spoilt. She had a fixation on her father, who was a pleasant man, and the family got on very well together. The patient was intelligent, but left school at the age of sixteen years to mind the home. At the age of twenty-three years she married, her husband having been her only boy friend. She had three children, the youngest at the time of the meeting being three and a half years old. She had had bad confinements and was much torn, and in 1950 the uterus had been removed as the cervical tears could not be mended. She had much pelvic pain, and because of dyspareunia often came into conflict with her husband, who became frustrated, and at times violent. Investigation of her earlier life revealed an incident when she was about eight years old involving a perverted school-master. That caused fear and a sense of guilt. Later, when she was aged about nineteen years, she had to submit to pre-marital intercourse until her marriage, and this worried her because she knew it to be wrong and risky. Shortly before the hysterectomy she abused a neighbour because he stored what she regarded as dangerous amounts of petrol in his home, and because he swept sawdust out of horse-floats over her washing. She was fined in court for her language, and felt ashamed of the affair. She also felt that the soiled sawdust called for much washing away when it blew over her clean washing. With a six months old baby to care for, severe pelvic pain, and the unkindness and sexual aberrations of her husband, she became exhausted bodily and mentally, and a little later began to carry out the washing rituals. She felt disgraced and unclean in her body and mind, and was afraid of people finding out her practices. At the present time, if she could not carry out her obsessive washing acts, she was tense, uncomfortable and restless. She did not like to be alone at night, and was irritable in crowds. A course of electroconvulsive therapy largely removed the depressive element, and a subsequent course of insulin therapy brought a gain in weight and much more contentment. The obsessive acts, however, persisted. She liked to discuss her story, and an attempt was being made to get her to link the present urges to the earlier sexual trauma aroused by the fear of the perverted school-master. Dr. Lawrance said that it was interesting to note that the recollection of the school-master story was aroused by memory during the insulin treatment, and while the patient was still very drowsy. At the present time she was very well, and it was hoped that permanent cure would result.

THE OPHTHALMOLOGICAL SOCIETY OF AUSTRALIA

(BRITISH MEDICAL ASSOCIATION).

THE eleventh annual meeting of the Ophthalmological Society of Australia (British Medical Association) was held at Hobart, under the presidency of Dr. J. Bruce Hamilton, during the week ending on Saturday, November 17, 1951. This meeting was designated the Jubilee Congress of the Society in honour of the centenary year of the Commonwealth of Australia.

His Excellency the Governor, Sir Ronald Cross, and Lady Cross gave a reception at Government House to members and guests and on a subsequent evening the Governor opened the congress with an inspiring address.

The meeting was attended by two distinguished guests from overseas, Dr. Henrik Sjögren, of Sweden, and Mr. Arthur Lister, of London. Forty-four members from the various States of the Commonwealth were present: Queensland, 1; New South Wales, 17; Victoria, 19; Tasmania, 5; Western Australia, 1.

Dr. Sjögren read papers on *kerato-conjunctivitis sicca* and on "Some Dystrophies of the Pigment Layer of the Retina". Mr. Lister spoke on the subjects of "Scleral Resection for Retinal Detachment" and "The Surgery of Congenital Glaucoma". Members of the Society contributed papers on "Anomalies of the Oblique Muscles", "Retrolental Fibroplasia", "Retinal Cysts" and "Facial Twitching". Amongst the cinematograph films which were shown was one in colour on lamellar corneal grafts by Professor Louis Paufique, of Lyons. This film was graciously lent by Professor Paufique through the courtesy of Dr. Cedric Cohen, who exhibited it and translated the sound track. Visits were made to the Tasmanian Institute for the Deaf and Blind and to the Sight Saving School.

The Lord Mayor of Hobart gave a reception to members and guests and the Premier, Mr. Robert Cosgrove, entertained them at a State luncheon. In addition great hospitality was received through the courtesy of the Minister for Health, Dr. David Turnbull, and from Tasmanian members and their wives. The annual dinner of the Society was held at Hadley's Hotel. At this function it was announced by the President that Dr. Sjögren and Mr. Lister had been elected honorary members of the Society.

The twelfth annual meeting is to be held at Melbourne in August, 1952, in conjunction with the eighth session of the Australasian Medical Congress (British Medical Association).

The newly elected president of the Society is Dr. George Brew, of Melbourne, and Dr. A. L. Tostevin, of Adelaide, is the vice-president. Dr. A. E. F. Chaffer was reelected honorary treasurer and Dr. Arnold Lance, 135 Macquarie Street, Sydney, was reelected honorary secretary.

Out of the Past.

In this column will be published from time to time extracts, taken from medical journals, newspapers, official and historical records, diaries and so on, dealing with events connected with the early medical history of Australia.

REMUNERATION OF MEDICAL MEN FOR PUBLIC SERVICES.[1]

[*Australian Medical Journal*, August 2, 1847.]

Tangible property has been long surrounded with all the defences which legal ingenuity could invent, and the Queen herself cannot take away a man's house or his land, nor appropriate his horse or his ox to the public service, without giving him compensation for the same, and yet the "Queen's Servants" have for a long time, in her name, been "levying blackmail" on the members of our profession, by compelling our attendance, and demanding our opinions, without any better remuneration than has been accorded to so many tinkers and cobblers. A professional opinion is, nevertheless, as much a piece of private property as a coat or a pair of breeches: and we might just as reasonably be expected to denude ourselves of the one as to give the other without value received. So far as regards matters of fact, we are amenable to the same liabilities in aid of justice as our fellow citizens, but when an opinion is required it is a very different affair, and we feel confident that were any member of our body public spirited and at the same time wealthy enough to try the question, his success would, in the end, be certain. We are glad, however, to see that a step in the right direction has, at last, been made, by the voting by the Legislative Council of the sum of £50 "to meet the expense of fees to medical practitioners who give evidence as to the state of persons in charge of the police as dangerous lunatics, at one guinea, for each case", and happening to be present in the gallery of "the House" on the introduction of this portion of the estimates, we had the gratification to hear both the Colonial Secretary and the Attorney General acknowledge our right to remuneration for services thus rendered to the public. For this, and for the manner in which the vote was passed, not a dissentient voice being raised against it, we in the name of the profession, thank those gentlemen and "the House".

An extract from the Lancet in another part of the Journal will shew the feeling of some, at least, of the Judges in Ireland on this subject, and we feel assured that if the profession in this Colony would take advantage of the present state of opinion in the Council, if they would, for once, lay aside personal antipathies and unite to strike "while the iron is hot" this important point would be gained; surely if there is a subject with which such feelings have nothing to do, this is one. The captious individual who would object to attach his name to a petition for this purpose, merely because another personally obnoxious to him had already done so, would be deserving only our contempt for his folly or our pity for his bad disposition.

If Mr Bland would turn his attention a little to such matters and leave alone others which he does not understand he might do something to earn our good opinion. Hitherto, we have nothing to thank him for—not a single motion, by which the profession, of which he is a member, might be benefitted has either originated from him or been supported by him. Nevertheless, were petitions to be sent from the various districts in the colony, praying for such a measure, he could scarcely, for shame, obstruct so palpable an act of justice, and we, therefore, tell our professional brethren throughout the land, that if the next session of the Council be allowed to pass without such an enactment, we are convinced they will only have their own apathy and supineness to thank for the delay. "Aide toi et le bon Dieu t'aidera."

[1] From the original in the Mitchell Library, Sydney.

Correspondence.

A CASE OF DEATH FOLLOWING SECTION, LIGATION AND INJECTION OF VARICOSE VEINS.

SIR: It is never considered wise to draw conclusions from a series of one case, and for that reason I hesitate to rush in with an opinion on the case reported by Dr. Coates (THE MEDICAL JOURNAL OF AUSTRALIA, September 22, 1951). However, one cannot let Dr. C. H. Wickham Lawes's letter pass without comment when he says: "Full strength 'Ethamolin' is a dangerous substance to use in conjunction with ligation and section of a vein. It should never be used. . . ." Dr. Coppleson rightly takes issue with this, pointing out that its almost general use shows how remote is the likelihood of trouble.

A few surgeons have used "Ethamolin" in massive doses. Dr. O. M. Moulden reported in THE MEDICAL JOURNAL OF AUSTRALIA (August 23, 1947) that he usually injects 12 to 15 millilitres, but did not state whether he operated on each leg singly or did the two on the one occasion. He also gives his considered opinion that: "Recurrence or recanalization is, in my experience, most frequently due to the use of an inadequate amount of sclerosing fluid at the primary operation." It would be interesting to know what amounts he uses now.

In personal experience, quoted in correspondence to the journal (September 20, 1947), the use of up to 30 millilitres in one leg was quoted. Experience since then has confirmed the absence of danger in massive doses of "Ethamolin". The last 150 cases have averaged 16 millilitres; the tendency to increase the dose is shown by the fact that in the last 50 cases the average has been 19 millilitres. The largest dose used in any individual was 33 millilitres. These enormous doses are used in cases where there are multiple anastomosing veins and consequently multiple incisions, some "Ethamolin" being injected into each section of the saphenous vein.

Dr. Wickham Lawes's fear that injecting "Ethamolin" near the ankle is dangerous is not supported by experience here. Where there is a large saphenous tree and no anastomosing veins have been demonstrated, the technique which has been used for the last fifteen years has been to pass a ureteric catheter from the incision in the groin as far down the leg as possible. Frequently this catheter is passed to its full length, the tip then being in the neighbourhood of the ankle joint, and in this situation "Ethamolin" is injected and massaged downwards into the saphenous tree. Injections of up to 18 millilitres have been made in this site (the remainder of the dose being injected as the catheter is withdrawn). The only untoward effect from these massive doses is that a small percentage of cases show a transitory nausea or even vomiting. This usually passes within thirty-six hours. On no occasion has any other complication been observed.

The folly of drawing general conclusions from one case is particularly evident in Dr. Coates's case, as death by

pulmonary embolism (or pulmonary thrombosis, according to which school you belong) is a complication of all sorts of operations. Is there any reason why it should not occur in the ordinary way in a saphenous vein operation, too?

Both Dr. Coates and Dr. Wickham Lawes do, however, recognize that this particular pulmonary complication occurred under exceptional circumstances—the operation was performed on a leg which had previously been the site of a deep thrombosis. Does not the logical inference from this single case appear to lie in this circumstance? If the woman had had a femoral thrombosis from a previous disturbance, why should she not have the same again when another operation was performed?

Would it not be correct to say that one should never perform a saphenous vein operation on a leg which has been the site of a previous deep thrombosis?

Yours, etc.,

421 Ruthven Street,
Toowoomba,
Queensland.
December 17, 1951.

MERVYN HALL.

AUSTRALIAN STATISTICS OF OPERATIVE INFECTION: A STANDARD WANTED.

SIR: I would be most appreciative if any hospital or clinic in Australia would publish its infection rate for clean operative cases—with especial reference to orthopædics. Such figures would constitute a most valuable standard the which to attain, or to surpass. It would, of course, be necessary to state the definition of infection employed. I suggest that failure to keep such records actually downgrades any hospital concerned.

Yours, etc.,

143 Macquarie Street,
Sydney,
January 2, 1952.

C. C. McKELLAR.

STREPTOMYCIN AND PHARMACEUTICAL BENEFITS.

SIR: It is over a year ago since Dr. Cotter Harvey, Dr. Bruce White, Dr. C. G. Bayliss, Dr. Alan Penington and I published in the pages of THE MEDICAL JOURNAL OF AUSTRALIA a plea for the more rational use of new antibiotics in the treatment of disease. It was stressed that certain of these drugs, if used in an indiscriminate manner, could encourage the emergence of a race of resistant organisms precluding their further effective use.

Too often we see respiratory infection treated in turn with sulphones, penicillin, streptomycin, "Chloromycetin" and aureomycin for weeks or even months, eventually being diagnosed as carcinoma or tuberculosis.

It appears now that some practitioners are going one step further and using expensive antibiotics as first choice in common ailments. Recently I have seen a whole family suffering from laryngitis each initially prescribed "Chloromycetin" on the grounds that they may as well have the latest and that the Government was paying the £50 odd bill for it anyhow.

Naturally drug houses, anxious to market these expensive products, will present to the doctors ever-widening indications for their use. One sees the spectacle of a pocket-size "penicillin snuffler" being advertised as a cure for a common cold or "its side effects". In such a way people can "snuffle" minute doses of penicillin happily all day long, until eventually there will not be a germ living that has not included penicillin resistance in its armamentarium. Perhaps the newer antibiotics will soon be made available in a similar form.

The empiric administration of "sulpha" drugs and penicillin has been blamed at least in part for the tenacity of present-day infections.

The position at present is that penicillin and streptomycin rapidly produce resistant organisms, but that "Chloromycetin" and aureomycin (at least *in vitro*) do not—however, we do not know what their long-range effect will be.

Organisms, wherever possible, should be "typed" for sensitivity to the proposed antibiotic, and where this cannot be done, at least a drug specific for the disease should be used.

The institution of "panels" for the control of such life-saving drugs is impracticable in many respects, but there is no question that in many cases they are being administered indiscriminately and are even replacing diagnosis. The fact that they are readily available to the patient at no cost has appeared to encourage this practice. With such wholesale use of newer antibiotics greater and greater doses will be needed as the germs become more resistant.

The dangers of such practice cannot be too highly stressed. Apart from the enormous cost incurred to the Government these drugs may lose their "life saving" significance and become useless in infections for which they are specific.

Yours, etc.,

Adelaide,
South Australia,
December 11, 1951.

R. MUNRO FORD.

RECURRENT PTERYGIUM.

SIR: In the initial series of cases discussed in my article on recurrent pterygium (THE MEDICAL JOURNAL OF AUSTRALIA, November 17, 1951) the principle of transplanting the head of the pterygium was adhered to in every instance in order to ascertain the recurrence rate associated with this procedure. In a relatively small number of cases the underlying subconjunctival tissue was dissected away, but the head was also transplanted. Dr. D'Ombrain is therefore quite correct in stating (THE MEDICAL JOURNAL OF AUSTRALIA, December 29, 1951) that in these cases his operative technique was not followed in its entirety. However, a few months ago I commenced a new series of cases using the technique exactly as described by Dr. D'Ombrain in the *British Journal of Ophthalmology* of February, 1948.

At this stage it is too early to assess the results.

Yours, etc.,

Wickham House,
Wickham Terrace,
Brisbane, B.17.
January 2, 1952.

J. GILCHRIST GIBSON.

PINK DISEASE AND ELECTROLYTE DISTURBANCE.

SIR: It is gratifying to find one's work leading to investigations which are throwing light on the problem of pink disease. However, I believe that the paper of Williams, Macdonald and Callow, by emphasizing findings which differed from ours, has not shown the advances in our knowledge of this disease, which their data reveal. Their data and ours reveal a significant hæmoconcentration, rise in hæmoglobin and plasma protein, and they demonstrate low serum chloride values. With respect to plasma sodium estimations, there is some disagreement, as the majority of their values are normal, whereas our values are consistently low. Emission spectrophotometry (used by us) does not offer the best means of estimating plasma sodium. The method used by the Melbourne workers is one of the best known, but it was unfortunate that the amount of serum used (0·2 millilitre) stretches the value of this technique to its very limits of accuracy. It is probably safe to state that a certain percentage of plasma sodium levels are abnormally low as this has also been the experience of other workers (Fanconi and Zellweger, personal communication). The data of Williams, Macdonald and Callow show strikingly high serum bicarbonate in many instances—values so high (40 milliequivalents per litre or 90 volumes *per centum*) that individual values must be regarded as significant regardless of an average that is in the normal range. As a matter of fact, their average bicarbonate concentration is high (30 milliequivalents per litre) since they calculated the figure given, incorrectly using 22 instead of 19 instances. It is difficult to understand why they failed to emphasize that alkalosis is often marked in pink disease. We were negligent in not determining serum bicarbonate and paid the penalty for our mistake.

This finding throws a different light on the evidence of electrolyte disturbance in pink disease. Adrenal insufficiency usually leads to a moderate reduction of serum bicarbonate along with a low serum sodium due to losses of body sodium and chloride. Furthermore, at least in the advanced stages of adrenal insufficiency, these changes cause a high concentration of serum potassium and a retention of potassium in the muscles. The data of Williams, Macdonald and

Callow, on the other hand, show essentially normal potassium concentration in the serum, as they point out, though a few values are low (three milliequivalents per litre).

There can be little doubt that the high hæmatocrit, with normal sodium concentration as these workers found, or with low concentration as we found, indicates low plasma volumes, and loss of plasma chloride and sodium. As a whole, the loss of sodium and chloride in extracellular fluid, in many examples, is of the same order of magnitude as the loss of plasma volume. However, data are not available to establish the magnitude of the deficits of sodium and chloride in the body as a whole in pink disease. I believe that the response of many cases to sodium chloride and desoxycorticosterone indicates that it is considerable in certain patients. Although it has not been clearly stated in published papers, one has observed that if the response to sodium chloride is not good in seven to ten days, little striking improvement accrues from its prolonged use. One would expect true adrenal insufficiency to require sodium chloride as long as the insufficiency persisted, and for these reasons one has probably been wrong in emphasizing the possibility of adrenal insufficiency as the origin of the electrolyte disturbance which occurs in pink disease.

Taking the evidence of alkalosis as a feature of this electrolyte disturbance, one's thinking is quite different. Vomiting as a symptom is not prominent and cannot be considered as a cause of alkalosis. Diarrhœa is not sufficient, except in the terminal stages, to explain early electrolyte losses. Nor is it likely that sweating *per se* could give rise to such an alkalosis. The disturbance must arise from an alteration in the renal regulation of acid-base equilibrium. Two possibilities come to mind. These patients eat so little food that the intake of potassium must be very low. In animals a low intake of potassium, combined with a high intake of sodium chloride, can produce a marked alkalosis, and this deficit of potassium leads also to a loss of chloride (Darrow, 1946, 1948). On the other hand, deficit of chloride can lead to a loss of cellular potassium. Attention has been recently directed to alkalosis resulting from mercurial diuretics (Schwartz and Wallace, 1951). Here chloride is sometimes excreted in excess of sodium producing alkalosis. Some of these patients show moderate deficits of potassium. In view of the hypothesis of Warkany—that pink disease is a result of a peculiar or hypersensitive reaction to mercury—the analogy is worth investigating. Owing to the marked anorexia in pink disease, these patients may show more pronounced deficits of potassium than cardiac patients receiving mercurials.

Obviously, we do not know the nature of the electrolyte disturbance in pink disease. However, we have obvious clues which indicate that the magnitude of the losses of sodium, chloride and potassium should be estimated. If cellular potassium depletion exists in pink disease, this would explain the variability of therapeutic results noticed after giving salt only—for sodium chloride will not properly correct alkalosis and chloride deficiency in the presence of cellular potassium depletion. Additional potassium is necessary.

The possibility that potassium deficiency explains the muscular weakness and gastro-intestinal disturbances must be explored and the nature of the disturbance of renal function defined in terms of modern concept.

Yours, etc.,

DONALD B. CHEEK,
Research Fellow, Department of Pediatrics, Yale University School of Medicine.

New Haven, Connecticut,
United States of America,
December 17, 1951.

References.

Darrow, D. C. (1946), "Changes in Muscle Composition in Alkalosis", *The Journal of Clinical Investigation*, Volume XXV, page 324.

———, Schwartz, R., Iannucci, J. F., and Coville, F. (1948), "The Relation of Serum Bicarbonate Concentration to Muscle Composition", *The Journal of Clinical Investigation*, Volume XXVII, page 198.

Schwartz, W. B., and Wallace, W. M. (1951), "Electrolyte Equilibrium during Mercurial Diuresis", *The Journal of Clinical Investigation*, Volume XXX, page 1089.

Williams, H., Macdonald, W. B., and Callow, V. (1951), "Pink Disease: Its Relation to Adrenal Function and the Value of Salt and Desoxycorticosterone in Treatment", THE MEDICAL JOURNAL OF AUSTRALIA, Volume I, page 363.

Medical Practice.

POLICE OFFENCES (AMENDMENT) ACT, 1908.

THE following amendment has been made to the regulations under the *Police Offences (Amendment) Act*, 1908, as amended.

The regulations are amended by omitting regulation No. 3 and by inserting in lieu thereof the following regulation:

3. (1) No person shall supply or procure, or offer to supply or procure, any drug unless

(*a*) (i) he is the holder of a licence in the form or to the effect of the form set out in Schedule 3 or Schedule 4 to the regulations; and (ii) he complies with the terms and conditions of the licence; and (iii) the person to whom the drug is supplied or on whose behalf the drug is procured is the holder of a licence or authority under the regulations or is otherwise authorised by regulations to have the drug in his possession; or

(*b*) the person to whom the drug is supplied or on whose behalf the drug is procured is the duly constituted authority in that behalf of the Commonwealth or of a Territory of the Commonwealth or is the holder of a licence or authority to have such drug in his possession under the law of any other State or of the Commonwealth or of any Territory of the Commonwealth.

(2) This regulation shall not apply to a person supplying or procuring, or offering to supply or procure, a drug if such person is acting within the scope of an authority conferred upon him by the regulations.

Australian Medical Board Proceedings.

NEW SOUTH WALES.

THE undermentioned have been registered, pursuant to the provisions of the *Medical Practitioners Act*, 1938-1945, as duly qualified medical practitioners: Breyer, Bruno Zdenko, M.D., 1935 (Univ. Padua), also recommended and approved for registration in terms of Section 17 (2) of the *Medical Practitioners Act*, 1938-1950; Chambers, Roland George, B.M., B.Ch., 1948 (Univ. Oxford); Cribb, George Desmond, M.R.C.S. (England), L.R.C.P. (London), 1939, F.R.C.S. (England), 1950; Davis, Rex Maurice, M.B., B.S., 1951 (Univ. Melbourne); Hood, James Hugh, M.B., B.S., 1947 (Univ. Queensland); Kendall, Colin Henri Gard, M.R.C.S. (England), L.R.C.P. (London), 1948, M.B., B.S., 1950 (Univ. London); Sefton, Leo, M.B., B.Chir., 1948 (Univ. Cambridge); Stewart, John Alexander Pollock, M.B., Ch.B., 1944 (Univ. Glasgow); Van Den Berg, Willem Jacob, registered in terms of Section 17B of the *Medical Practitioners Act*, 1938-1950; Wells, Ernest Kenneth Bethune, L.R.C.P. (Edinburgh), L.R.C.S. (Edinburgh), L.R.F.P.S. (Glasgow), 1951.

The following additional qualifications have been registered: Anderson, Thomas William (M.B., B.S., 1946, Univ. Sydney), D.D.R. (Univ. Sydney), 1950; Landecker, Hans Martin (Section 17B of *Medical Practitioners Act*, 1938-1945), M.R.A.C.P., 1951; Nagy, Gabriel Stephen (M.B., B.S., 1946, Univ. Sydney), M.R.C.P. (London), 1951; Woodhouse, Edward Beaumont (M.R.C.S., England, L.R.C.P., London, 1935), D.T.M. (Calcutta), 1931.

QUEENSLAND.

THE undermentioned have been registered, pursuant to the provisions of *The Medical Acts*, 1939-1948, as duly qualified medical practitioners: Andermann, Karl, M.B., B.S., 1951 (Univ. Queensland); Ash, Roland Fortescue, M.B., B.S., 1951 (Univ. Queensland); Beer, Neville, M.B., B.S., 1951 (Univ. Queensland); Bendeich, Geoffrey Joseph, M.B., B.S., 1951 (Univ. Queensland); Benness, Geoffrey Thomas, M.B., B.S., 1951 (Univ. Queensland); Binnie, John Everard, M.B., B.S., 1951 (Univ. Queensland); Bradshaw, Alan Robert, M.B., B.S., 1951 (Univ. Queensland); Brady, Keith Ferguson, M.B., B.S., 1951 (Univ. Queensland); Brennan, Kevin Francis,

M.B., B.S., 1951 (Univ. Queensland); Briggs, Geoffrey Spencer, M.B., B.S., 1951 (Univ. Queensland); Broe, Muriel Rose, M.B., B.S., 1951 (Univ. Queensland); Brophy, Teresa Rita O'Rourke, M.B., B.S., 1951 (Univ. Queensland); Cilento, Carl Lindsay, M.B., B.S., 1951 (Univ. Queensland); Cooper, Lorna Marguerite, M.B., B.S., 1951 (Univ. Queensland); Copeman, Herbert Arthur, M.B., B.S., 1951 (Univ. Queensland); Dickinson, Rita Deidre, M.B., B.S., 1951 (Univ. Queensland); Esler, Edwin John, M.B., B.S., 1951 (Univ. Queensland); Ferrier, Thomas Mayne, M.B., B.S., 1951 (Univ. Queensland); Gallagher, Madeleine Mary, M.B., B.S., 1951 (Univ. Queensland); Garlick, Frank Hender, M.B., B.S., 1951 (Univ. Queensland); Gibbons, Wylie David, M.B., B.S., 1951 (Univ. Queensland); Godwin, Raymond Peter, M.B., B.S., 1951 (Univ. Queensland); Graff, John Frederick Hubert, M.B., B.S., 1951 (Univ. Queensland); Greenslade, Clifford Francis, M.B., B.S., 1951 (Univ. Queensland); Gutteridge, Bruce Health, M.B., B.S., 1951 (Univ. Queensland); Hallback, Mavis, M.B., B.S., 1951 (Univ. Queensland); Hayes, Kenneth Robert, M.B., B.S., 1951 (Univ. Queensland); Hennessey, John Francis, M.B., B.S., 1951 (Univ. Queensland); Hilton, William Murray, M.B., B.S., 1951 (Univ. Queensland); Holle, Ian Stanley, M.B., B.S., 1951 (Univ. Queensland); Horner, Alexander Montague, M.B., B.S., 1951 (Univ. Queensland); Hutton, Paul James John, M.B., B.S., 1951 (Univ. Queensland); Johnson, Neva Mildred, M.B., B.S., 1951 (Univ. Queensland); Joyce, James Humphrey, M.B., B.S., 1951 (Univ. Queensland); Kearley, Alan Spence, M.B., B.S., 1951 (Univ. Queensland); Kelly, D'Arcy, M.B., B.S., 1951 (Univ. Queensland); Kleinig, Daniel Egbert, M.B., B.S., 1951 (Univ. Queensland); Langan, George Browne, M.B., B.S., 1951 (Univ. Queensland); McClymont, Donald Hugh, M.B., B.S., 1951 (Univ. Queensland); McGovern, William Edmund, M.B., B.S., 1951 (Univ. Queenslend); McGuckin, Desmond David, M.B., B.S., 1951 (Univ. Queensland); Macey, Thomas Herbert Edward, M.B., B.S., 1951 (Univ. Queensland); Mackay, John Ewan, M.B., B.S., 1951 (Univ. Queensland); Mackenzie, William Keith Ross, M.B., B.S., 1951 (Univ. Queensland); Marshall, Murray Scott, M.B., B.S., 1951 (Univ. Queensland); Milne, John Edmondstone, M.B., B.S., 1951 (Univ. Queensland); Mitchell, Kenneth Robert, M.B., B.S., 1951 (Univ. Queensland); Monahan, Ross Gregory, M.B., B.S., 1951 (Univ. Queensland); Morrison, William John, M.B., B.S., 1951 (Univ. Queensland); Nicolaides, Nicholas John, M.B., B.S., 1951 (Univ. Queensland); Nimmo, David Bruce, M.B., B.S., 1951 (Univ. Queensland); O'Duffy, John Francis, M.B., B.S., 1951 (Univ. Queensland); Parker, Neville Edward, M.B., B.S., 1951 (Univ. Queensland); Purssey, Brian Swan, M.B., B.S., 1951 (Univ. Queensland); Roberts, Graeme Bruce, M.B., B.S., 1951 (Univ. Queensland); Robertson, Bruce McKenzie, M.B., B.S., 1951 (Univ. Queensland); Robertson, Peter Reginald, M.B., B.S., 1951 (Univ. Queensland); Ross, Robert Fuller, M.B., B.S., 1951 (Univ. Queensland); Rowsell, John Brian, M.B., B.S., 1951 (Univ. Queensland); Ruffle, Frederick Cook, M.B., B.S., 1951 (Univ. Queensland); Russell, Maurice, M.B., B.S., 1951 (Univ. Queensland); Ryan, James Geoffrey Pennefather, M.B., B.S., 1951 (Univ. Queensland); Scanlan, Brian John, M.B., B.S., 1951 (Univ. Queensland); Schubert, Frederick, M.B., B.S., 1951 (Univ. Queensland); Schwarz, David Archibald, M.B., B.S., 1951 (Univ. Queensland); Stark, Leslie Strafford, M.B., B.S., 1951 (Univ. Queensland); Syme, James Robert, M.B., B.S., 1951 (Univ. Queensland); Thomson, John Robert, M.B., B.S., 1951 (Univ. Queensland); Trist, Alan Robert, M.B., B.S., 1951 (Univ. Queensland); Urquhart, Gordon Stitt, M.B., B.S., 1951 (Univ. Queensland); Von Alpen, Hugo Ulrich Herbert, M.B., B.S., 1951 (Univ. Queensland); Wagner, John Howard Wilfred, M.B., B.S., 1951 (Univ. Queensland); Webster, David Colin, M.B., B.S., 1951 (Univ. Queensland); Wilkinson, Keith Francis, M.B., B.S., 1951 (Univ. Queensland); Williams, Murray Gowan, M.B., B.S., 1951 (Univ. Queensland); Wilson, Fergus Roy, M.B., B.S., 1951 (Univ. Queensland); Windrum, Graham Melrose, M.B., B.S., 1951 (Univ. Queensland); Yelland, John Douglas Newman, M.B., B.S., 1951 (Univ. Queensland); Wells, Ernest Kenneth Bethune, L.R.C.P. (Edinburgh), 1951, L.R.C.S. (Edinburgh), 1951, L.R.F.P. and S. (Glasgow), 1951; Fenwick, Louis, M.B., B.S., 1950 (Univ. Sydney); McCready, Ian Anthony Jobson, M.R.C.S. (England), L.R.C.P. (London), 1942; Cooke, William Derek Domville, M.R.C.S. (England), 1943, L.R.C.P. (London), 1943, D.C.H., R.C.P. and S. (London), 1948; Healy, John Rambaut, M.B., B.Ch., B.A.O., 1941 (Univ. Dublin); Bouche, Benjamin Jasper, M.R.C.S. (England), L.R.C.P. (London), 1928; McQueen, Ewen Garth, M.B., B.S., 1940 (Univ. Sydney), M.R.C.P. (London), 1949, M.R.A.C.P., 1949; Waddell, Henry James, M.B., 1911 (Univ. Sydney); Weber, Leighton Otto Davis, M.B., 1943, B.S., 1944 (Univ. Sydney).

The following additional qualifications have been registered: Johnston, Edward Douglas, D.D.R. (Univ. Sydney), 1951; Phillips, Bertram James, D.P.M. (Univ. London), 1951; Gibson, John Bertram Gilchrist, Diploma in Ophthalmology (Univ. Sydney), 1951; Hill, James Allan, Diploma in Gynæcology and Obstetrics (Univ. Sydney), 1951.

TASMANIA.

THE undermentioned have been registered, pursuant to the provisions of the *Medical Act*, 1918, as duly qualified medical practitioners: Nally, John Brendon Aloysius, L.M., 1948, R.C.P. (Ireland), March, 1948, R.C.S. (Ireland); Lethlean, Peter John, M.B., B.S., 1951 (Univ. Melbourne).

Public Health.

HEARING AIDS FOR CHILDREN.

THE following statement is published at the request of the Director-General of Health, Canberra.

A benefit under the Commonwealth Health Service is the provision of hearing aids and subsequent maintenance and batteries without charge to all deaf school and pre-school children who might benefit. These aids are provided through the acoustic laboratories attached to the Commonwealth health departments in each capital city.

Most of the deaf children are referred from the deaf schools and through the school medical services. The department cooperates with the school medical services by the loan, through the laboratories, of small portable battery audiometers designed for screen testing in schools. Because of the very large number of school children, full screening of all children, and in particular of country children, has not yet been possible.

It is thought that many deaf school and pre-school children may be known to medical practitioners who are not familiar with the benefits and facilities provided. Besides the provision and maintenance of the hearing aid, the acoustic laboratories assist in determining degrees of deafness for diagnostic purposes. Cooperation by the medical profession generally in referring any such deafness or any suspected deaf children to the acoustic laboratories of the Commonwealth Department of Health in capital cities will ensure that all children able to benefit are assisted. Preliminary medical examination to ensure that all possible remedial medical or surgical treatment is first undertaken is essential before the child is considered for issue of hearing aid.

Naval, Military and Air Force.

APPOINTMENTS.

THE undermentioned appointments, changes *et cetera* have been promulgated in the *Commonwealth of Australia Gazette*, Number 94, of December 20, 1951.

CITIZEN NAVAL FORCES OF THE COMMONWEALTH.

Royal Australian Naval Reserve.

Appointments.—Richard Kernan Newing (Surgeon Lieutenant, Royal Australian Naval Volunteer Reserve) is appointed Surgeon Lieutenant, with seniority in rank of 10th August, 1945, dated 27th March, 1951 (amending Executive Minute No. 26 of 15th June, 1951). Benjamin Edward Brookman is appointed Surgeon Lieutenant, dated 27th August, 1951.

Royal Australian Naval Volunteer Reserve.

District Naval Medical Officer.—Surgeon Commander Stephen Creighton Suggit is appointed District Naval Medical Officer, Brisbane, dated 1st October, 1951.

CITIZEN MILITARY FORCES.

Eastern Command: Second Military District.

Royal Australian Army Medical Corps (Medical).—2/50455 Major A. E. McGuinness, M.C., is appointed Deputy Director of Medical Services, Headquarters Eastern Command, and

to be Lieutenant-Colonel (Temporary Colonel), 16th October, 1951. To be Captains (provisionally), 11th October, 1951: 2/146595 Anthony Wilbraham Tollemache Edwards and 2/146576 Charles Andrew Rigg.

Southern Command: Third Military District.

Royal Australian Army Medical Corps (Medical).—3/63671 Major K. H. Heard is appointed to command 4th Field Ambulance and to be Lieutenant-Colonel, 1st September, 1951. 3/51010 Major R. B. Maynard is appointed to command 6th Field Ambulance and to be Lieutenant-Colonel, 1st September, 1951. 3/101801 Lieutenant-Colonel C. H. Johnston relinquishes command of 6th Field Ambulance and is transferred to the Reserve of Officers (Royal Australian Army Medical Corps (Medical)) (3rd Military District), 31st August, 1951. To be Captain (provisionally), 11th October, 1951: 3/114175 Philip Stretton.

Post-Graduate Work.

SEMINARS AT ROYAL PRINCE ALFRED HOSPITAL.

THE following seminars will be held at the Royal Prince Alfred Hospital, Camperdown, New South Wales, between February 1 and July 11, 1952. Each seminar is held in the A2 lecture theatre on Friday between 1.15 and 2.15 p.m. All medical graduates are invited to attend.

February 1, cardio-vascular section, "Pulmonary Embolism". February 8, endocrinology and metabolism section, a review of ACTH and cortisone therapy and experience at Royal Prince Alfred Hospital. February 15, hæmatology section, "Acquired Hæmolytic Anæmia". February 22, gastro-enterology section, "Steatorrhœa". February 29, thoracic section, "The Significance of Acid-Fast Bacilli in the Sputum".

March 7, neurology section, "Peripheral Neuropathy and Pyruvate Metabolism". March 14, allergy section, "The Value of Skin Testing". March 21, pathology section, clinico-pathological conference. March 28, cardio-vascular section, "Cation Exchange Resins".

April 4, endocrinology and metabolism section, a review of liver function tests and experiences at Royal Prince Alfred Hospital. April 11, no seminar. April 18, dermatology section, "Localized Myxœdema". April 25, hæmatology section, "The Role of the Bone Marrow in Hæmatological Diagnosis".

May 2, gastro-enterology section, "Infective Hepatitis". May 9, pædiatrics section, "The Care of the Pregnant Diabetic and Her Newborn Infant". May 16, thoracic section, "Upper Lobe Collapse". May 23, cardio-vascular section, "Anticoagulant Therapy". May 30, endocrinology and metabolism section, "Cholesterol Metabolism".

June 6, pathology section, clinico-pathological conference. June 13, hæmatology section, "Incompatible Blood Transfusion". June 20, arthritis clinic, "Ankylosing Spondylitis". June 27, July 4 and 11, neurology section, Dr. McDonald Critchley (London).

Medical Appointments.

Dr. N. D. Hicks has been appointed assistant clinical pathologist in the Institute of Medical and Veterinary Science, Adelaide.

Dr. J. F. Jackson has been appointed clinical research officer in the Institute of Medical and Veterinary Science, Adelaide.

Dr. Kathleen M. Winning has been appointed honorary physician to the Royal Alexandra Hospital for Children, Camperdown, New South Wales.

Dr. C. W. G. Lee has been appointed honorary assistant physician to the Royal Alexandra Hospital for Children, Camperdown, New South Wales.

Dr. D. K. Grant and Dr. R. H. Vines have been appointed honorary relieving assistant physicians to the Royal Alexandra Hospital for Children, Camperdown, New South Wales.

Dr. R. Hertzberg has been appointed honorary ophthalmic surgeon to the Royal Alexandra Hospital for Children, Camperdown, New South Wales.

Dr. C. H. Baker has been appointed honorary assistant ophthalmic surgeon to the Royal Alexandra Hospital for Children, Camperdown, New South Wales.

Dr. R. H. Curry has been appointed a public vaccinator for the Shire of Minhamite, Victoria.

Dr. E. W. Hands has been appointed a public vaccinator for the Shire of Wangaratta, Victoria.

Dr. L. C. E. Lindon has been appointed honorary consulting neurosurgeon at the Royal Adelaide Hospital.

Dr. J. E. Cawte has been appointed deputy superintendent (Enfield Receiving House) in the Hospitals Department of South Australia.

Dr. F. L. D. Young has been appointed deputy superintendent of the Parkside Mental Hospital, South Australia.

Dr. F. G. Bell has been appointed pathological registrar at the Royal Adelaide Hospital.

Obituary.

JAMES FINLAY PATRICK.

WE regret to announce the death of Dr. James Finlay Patrick, which occurred on January 6, 1952, at Hawthorn, Victoria.

Nominations and Elections.

THE undermentioned have applied for election as members of the New South Wales Branch of the British Medical Association:

Breyer, Bruno Zdenko, registered in accordance with *Medical Practitioners Act*, 1938-1951, Section 17 (2), 14 Prince Edward Park Road, Woronora (Sutherland).

Hinds, Neville Albert, M.B., B.S., 1951 (Univ. Sydney), 21 Dover Road, Rose Bay.

McGill, John Charles, M.B., B.S., 1951 (Univ. Sydney), c.o. Mrs. Stringfellow, 14 Wyalong Street, Burwood.

Saad, Ronald Shalhoub, M.B., B.S., 1951 (Univ. Sydney), 94 Redfern Street, Redfern.

The undermentioned have been elected members of the New South Wales Branch of the British Medical Association:

Borkman, Heino, provisional registration M.B., B.S., 1952 (Univ. Sydney), 419 Cabramatta Road, Cabramatta.

Bryan, Ian James, M.B., B.S., 1947 (Univ. Sydney), 33 Stuart Street, Longueville.

Chapman, Maxwell Graham, provisional registration M.B., 1952 (Univ. Sydney), Narrandera District Hospital, Narrandera.

Cousins, Adrian Gordon, provisional registration M.B., 1952 (Univ. Sydney), 27 Redman Parade, Belmore.

Crawshaw, Brian Keith, provisional registration M.B., 1952 (Univ. Sydney), St. George Hospital, Kogarah.

Cull, Francis William, M.B., B.S., 1951 (Univ. Sydney), 9 Ivy Street, Wollstonecraft.

Dawson, Bruce Hamilton, provisional registration M.B., 1952 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.

Feather, Robert Hartley, provisional registration M.B., 1952 (Univ. Sydney), 39 Merrenburn Avenue, Naremburn.

Gomm, Audrey Mabel, provisional registration M.B., 1952 (Univ. Sydney), District Hospital, Balmain.

Govorko, Laddie Alexander, provisional registration M.B., 1952 (Univ. Sydney), 77 Smith Street, Wentworthville.

Hallet, Philip, provisional registration M.B., 1952 (Univ. Sydney), 12 Judge Street, Randwick.

Hanks, Geoffrey Noel, provisional registration M.B., 1952 (Univ. Sydney), Balmain and District Hospital, Balmain.

Houghton, Roy Malcolm, provisional registration M.B., 1952 (Univ. Sydney), 26 Burton Street, Concord.

Humphris, Philip Blake, provisional registration M.B., 1952 (Univ. Sydney), 100 Shirley Road, Roseville.

Kennedy, John Anthony, M.B., B.S., 1950 (Univ. Sydney), Lewisham General Hospital, Lewisham.

DISEASES NOTIFIED IN EACH STATE AND TERRITORY OF AUSTRALIA FOR THE WEEK ENDED DECEMBER 22, 1951.[1]

Disease.	New South Wales.	Victoria.	Queensland.	South Australia.	Western Australia.	Tasmania.	Northern Territory.[2]	Australian Capital Territory.	Australia.[3]
Acute Rheumatism	..	..	..	..	..	..	..	..	..
Amœbiasis	..	..	..	..	..	..	..	..	..
Ancylostomiasis	..	..	3	..	..	..	..	..	3
Anthrax	..	..	..	..	..	..	..	..	..
Bilharziasis	..	..	..	..	..	..	..	..	..
Brucellosis	..	1	..	..	..	..	..	..	1
Cholera	..	..	..	..	..	..	..	..	..
Chorea (St. Vitus)	..	..	..	..	..	..	..	..	..
Dengue	..	..	..	..	..	..	..	..	..
Diarrhœa (Infantile)	..	..	12(2)	..	..	..	..	..	12
Diphtheria	2	1(1)	3(2)	..	7(7)	..	..	..	13
Dysentery (Bacillary)	..	..	2(2)	..	..	..	..	..	2
Encephalitis	..	..	..	..	..	..	..	..	..
Filariasis	..	..	..	..	..	..	..	..	..
Homologous Serum Jaundice	..	..	..	..	..	..	..	..	..
Hydatid	..	1	..	..	..	..	..	..	1
Infective Hepatitis	..	..	..	..	7(2)	..	..	..	7
Lead Poisoning	..	..	..	..	..	..	..	..	..
Leprosy	..	..	..	..	..	..	..	..	..
Leptospirosis	..	..	..	..	..	..	..	..	..
Malaria	..	..	2(2)	..	..	..	..	..	2
Meningococcal Infection	4(2)	5(1)	..	1(1)	1	..	..	..	11
Ophthalmia	..	..	..	..	..	..	..	..	..
Ornithosis	..	..	..	..	..	..	..	..	..
Paratyphoid	..	..	..	..	..	..	..	..	..
Plague	..	..	..	..	..	..	..	..	..
Poliomyelitis	6(4)	2	15(10)	27(13)	..	..	..	..	50
Puerperal Fever	..	2(2)	..	1	1(1)	..	..	..	4
Rubella	..	9(4)	1	..	6(6)	..	..	4	20
Salmonella Infection	..	..	..	..	1	..	..	..	1
Scarlet Fever	20(9)	16(10)	5(3)	..	3(3)	5	..	..	49
Smallpox	..	..	..	..	..	..	..	..	..
Tetanus	..	..	..	..	..	..	..	..	..
Trachoma	..	..	..	..	..	..	..	..	..
Trichinosis	..	..	..	..	..	..	..	..	..
Tuberculosis	28(20)	20(11)	9(1)	10(7)	6(2)	4	..	..	77
Typhoid Fever	..	..	..	..	..	..	..	..	..
Typhus (Flea-, Mite- and Tick-borne)	1(1)	..	..	..	..	..	..	..	1
Typhus (Louse-borne)	..	..	..	..	..	..	..	..	..
Yellow Fever	..	..	..	..	..	..	..	..	..

DISEASES NOTIFIED IN EACH STATE AND TERRITORY OF AUSTRALIA FOR THE WEEK ENDED DECEMBER 29, 1951.[1]

Disease.	New South Wales.	Victoria.	Queensland.	South Australia.	Western Australia.	Tasmania.	Northern Territory.[2]	Australian Capital Territory.	Australia.[3]
Acute Rheumatism	..	..	..	..	1	..	..	..	1
Amœbiasis	..	..	..	..	..	..	..	..	..
Ancylostomiasis	..	..	..	..	..	..	..	..	..
Anthrax	..	..	..	..	..	..	..	..	..
Bilharziasis	..	..	..	..	..	..	..	..	..
Brucellosis	..	..	..	..	..	..	..	..	..
Cholera	..	..	..	..	..	..	..	..	..
Chorea (St. Vitus)	..	..	..	..	..	..	..	..	..
Dengue	..	..	..	..	..	..	..	..	..
Diarrhœa (Infantile)	..	..	7(7)	..	..	..	..	..	7
Diphtheria	1	8(7)	..	..	3(3)	..	..	..	12
Dysentery (Bacillary)	..	..	7(6)	..	..	..	..	1	8
Encephalitis	..	1(1)	..	..	1	..	..	..	2
Filariasis	..	..	..	..	..	..	..	..	..
Homologous Serum Jaundice	..	..	..	..	..	..	..	..	..
Hydatid	..	1	..	..	..	..	..	..	1
Infective Hepatitis	..	..	..	..	5(1)	..	..	..	5
Lead Poisoning	..	..	..	..	..	..	..	..	..
Leprosy	..	..	..	..	..	..	..	..	..
Leptospirosis	..	..	..	..	..	..	..	..	..
Malaria	..	..	..	..	..	..	..	..	..
Meningococcal Infection	4(3)	1(1)	..	..	1(1)	..	..	..	6
Ophthalmia	..	..	..	..	..	..	..	..	..
Ornithosis	..	..	..	..	..	..	..	..	..
Paratyphoid	..	..	..	..	..	..	..	..	..
Plague	..	..	..	..	..	..	..	..	..
Poliomyelitis	3(2)	2	11(8)	15(7)	1	..	..	1	33
Puerperal Fever	..	..	..	..	..	..	..	..	..
Rubella	..	1(1)	..	..	4(4)	..	..	..	5
Salmonella Infection	..	..	..	..	..	..	..	..	..
Scarlet Fever	9(7)	14(7)	2(2)	1(1)	2(2)	..	..	..	28
Smallpox	..	..	..	..	..	..	..	..	..
Tetanus	..	..	..	..	..	..	..	..	..
Trachoma	..	..	..	..	..	..	..	..	..
Trichinosis	..	..	..	..	..	..	..	..	..
Tuberculosis	19(12)	3(2)	18(12)	10(10)	..	..	..	..	50
Typhoid Fever	..	..	..	..	..	..	..	..	..
Typhus (Flea-, Mite- and Tick-borne)	..	..	1	..	..	..	..	..	1
Typhus (Louse-borne)	..	..	..	..	..	..	..	..	..
Yellow Fever	..	..	..	..	..	..	..	..	..

[1] Figures in parentheses are those for the metropolitan area.

[2] Figures not available.

[3] Figures incomplete owing to absence of returns from the Northern Territory.

Liggins, Anthony William, provisional registration M.B., 1952 (Univ. Sydney), Royal Newcastle Hospital, Newcastle.

Manning, René Lionel, provisional registration M.B., 1952 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.

Messmer, Bruce Anthony, provisional registration M.B., 1952 (Univ. Sydney), District Hospital, Leeton.

Mitchell, Robert Ian, M.B., B.S., 1951 (Univ. Sydney), Royal North Shore Hospital, St. Leonards.

MacDonald, Colin Bruce, M.B., B.S., 1950 (Univ. Sydney), 22 Yangoora Road, Belmore.

Pearson, Bruce Samuel, M.B., B.S., 1950 (Univ. Sydney), c.o. Bank of New South Wales, Berkeley Square, London, W.1, England (temporary).

Pozniak, Maurice, provisional registration M.B., 1952 (Univ. Sydney), District Hospital, Cootamundra.

Robertson, Struan Birrell, provisional registration M.B., 1952 (Univ. Sydney), 155 Wycombe Road, Neutral Bay.

Sainsbury, Maurice Joseph, provisional registration M.B., 1952 (Univ. Sydney), District Hospital, Cowra.

Sander, John Frederick, provisional registration M.B., 1952 (Univ. Sydney), St. Joseph's Hospital, Auburn.

Shapiro, Ralph Abraham, provisional registration M.B., 1952 (Univ. Sydney), District Hospital, Queanbeyan.

Steele-Smith, John Henry, provisional registration M.B., 1952 (Univ. Sydney), Sydney Hospital, Sydney.

Stern, Eric, provisional registration M.B., 1952 (Univ. Sydney), Flat 12, 7 O'Brien Street, Bondi Beach.

Sturrock, John Barry, provisional registration M.B., 1952 (Univ. Sydney), 12 Juliette Avenue, Punchbowl.

Thwaites, Cedric Francis, M.B., B.S., 1950 (Univ. Sydney), 55 Manson Road, Strathfield.

Tonkin, John Paul, M.B., B.S., 1951 (Univ. Sydney), 5 Arthur Street, Bellevue Hill.

Trevillian, Kenneth James, provisional registration M.B., 1952 (Univ. Sydney), Armidale and New England District Hospital, Armidale.

Utber, Walter Beresford, provisional registration M.B., 1952 (Univ. Sydney), 1 Hill Street, Roseville.

Wade, Eric Arnold, provisional registration M.B., 1952 (Univ. Sydney), Lucinda Avenue South, Wahroonga.

Whitington, Ronald Ernest, M.B., B.S., 1951 (Univ. Sydney), c.o. Dr. S. A. Railton, 22 Macquarie Street, Taree.

Wright-Short, Frederick William, provisional registration M.B., 1952 (Univ. Sydney), 49 Victor Road, Dee Why.

The undermentioned have applied for election as members of the South Australian Branch of the British Medical Association:

Pavy, John Keith, M.B., B.S., 1951 (Univ. Adelaide), 48 Northumberland Street, Tusmore.

Gooden, Philip Compson, M.B., B.S., 1951 (Univ. Adelaide), 10 Heathpool Road, Heathpool.

Jones, Robert Britten, M.B., B.S., 1951 (Univ. Adelaide), 74 Hill Street, North Adelaide.

Sheedy, Redmond Stuart Parnell, M.B., B.S., 1951 (Univ. Adelaide), 86 Henry Street, West Croydon.

Trauer, Robert, M.B., B.S., 1951 (Univ. Adelaide), 39 Lewanick Street, Allenby Gardens.

Goode, Thomas Britten, M.B., B.S., 1951 (Univ. Adelaide), 29 Commercial Road, Hyde Park.

Madigan, Michael Roebourne, M.B., B.S., 1951 (Univ. Adelaide), Cliff Street, Blackwood.

Senior, Rex Clifton, M.B., B.S., 1951 (Univ. Adelaide), 27 Robert Street, Croydon.

Carter, Ian Dan, M.B., B.S., 1951 (Univ. Adelaide), 41 Opey Avenue, Unley.

Collins, John Malcolm, M.B., B.S., 1951 (Univ. Adelaide), 38 Hounslow Avenue, Torrensville.

Lindon, John Leonard Henry, M.B., B.S., 1951 (Univ. Adelaide), 8 Prospect Road, Fitzroy.

LePage, Keith Ernest, M.B., B.S., 1951 (Univ. Adelaide), 48 Allinga Avenue, Glenside.

Newland, Ben Totham Jervois, M.B., B.S., 1951 (Univ. Adelaide), 3 Avenel Gardens Road, Medindie.

Proudman, William David, M.B., B.S., 1951 (Univ. Adelaide), 92 Moseley Street, Glenelg.

Yates, Thomas Morey, M.B., B.S., 1951 (Univ. Adelaide), 150 Alexandra Avenue, Toorak Gardens.

Ungar, Emeric Imre, M.B., B.S., 1951 (Univ. Adelaide), 23 Craighill Road, St. Georges.

Leaney, Cecil John, M.B., B.S., 1951 (Univ. Adelaide), 2 Willingale Avenue, Lockleys.

Saver, Henri Hugo Albert, M.B., B.S., 1951 (Univ. Adelaide), 28 Walkers Road, Somerton Park.

Baldacchino, Charles Francis, M.B., B.S., 1951 (Univ. Adelaide), 211 Grange Road, Flinder's Park.

Badger, John Robert, M.B., B.S., 1951 (Univ. Adelaide), 130 Swaine Avenue, Toorak Gardens.

Turner, Arthur Noel, M.B., B.S., 1951 (Univ. Adelaide), 25 Mitchell Street, Seaton Park.

Walker, John Adrian Mozar, M.B., B.S., 1951 (Univ. Adelaide), 17 Dover Street, Malvern.

Thornton, Digby Noel, M.B., B.S., 1950 (Univ. Adelaide), 5 Eric Avenue, Black Forest.

England, Ernest James, M.B., B.S., 1951 (Univ. Adelaide), 194 Stirling Highway, Cottesloe.

The undermentioned have been elected members of the South Australian Branch of the British Medical Association:

Geisler, Frederick, M.B., B.S., 1950 (Univ. Adelaide), 69 Phillis Street, Maylands.

Lowe, Daphne Rae, M.B., B.S., 1951 (Univ. Adelaide), 25 Railway Terrace, Alberton East .

Diary for the Month.

JAN. 25.—Queensland Branch, B.M.A.: Council Meeting.
FEB. 1.—Queensland Branch, B.M.A.: Branch Meeting.
FEB. 5.—New South Wales Branch, B.M.A.: Organization and Science Meeting.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Medical Secretary, 135 Macquarie Street, Sydney): All contract practice appointments in New South Wales.

Victorian Branch (Honorary Secretary, Medical Society Hall, East Melbourne): Associated Medical Services Limited; all Institutes or Medical Dispensaries; Australian Prudential Association, Proprietary, Limited; Federal Mutual Medical Benefit Society; Mutual National Provident Club; National Provident Association; Hospital or other appointments outside Victoria.

Queensland Branch (Honorary Secretary, B.M.A. House, 225 Wickham Terrace, Brisbane, B17): Brisbane Associated Friendly Societies' Medical Institute; Bundaberg Medical Institute. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.

South Australian Branch (Honorary Secretary, 178 North Terrace, Adelaide): All Contract Practice appointments in South Australia.

Western Australian Branch (Honorary Secretary, 205 Saint George's Terrace, Perth): Norseman Hospital; all Contract Practice appointments in Western Australia. All government appointments with the exception of those of the Department of Public Health.

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